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Index to Advertisers and Classified Index Following Reading Matter.

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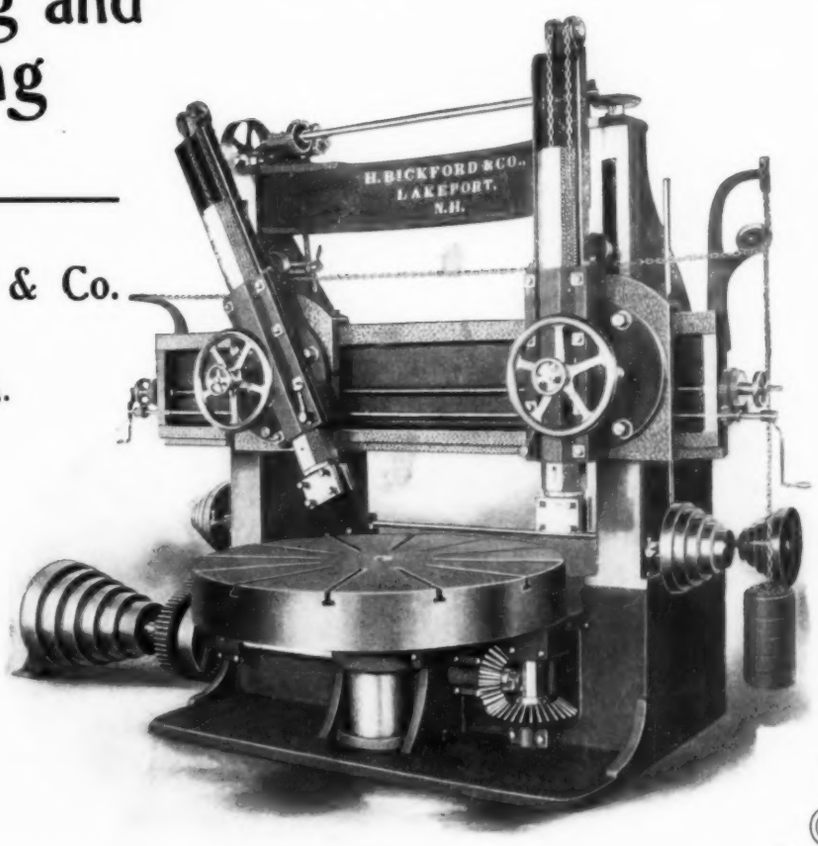

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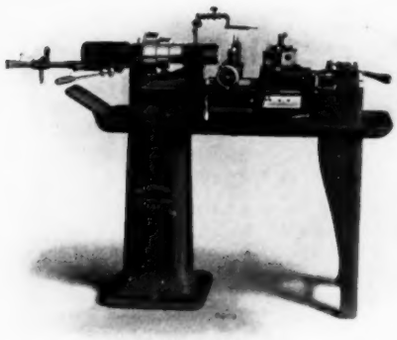
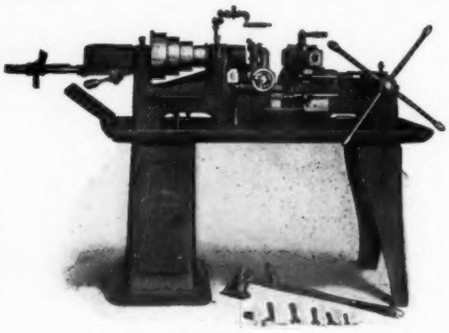


⅝ x 4½ inch.



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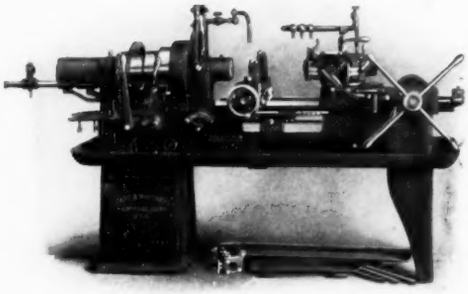

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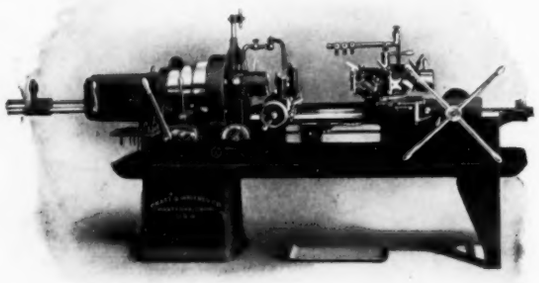
The most powerful, rapid and accurate machines on the market for rod work up to three inches in diameter.



2 x 26 inch.

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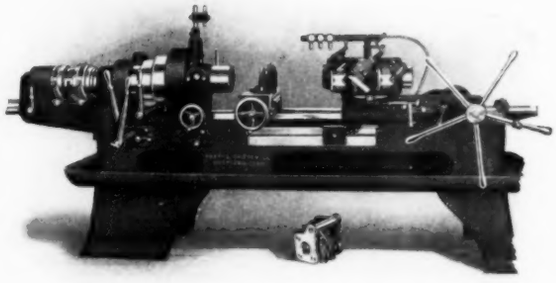

3 x 36 inch.

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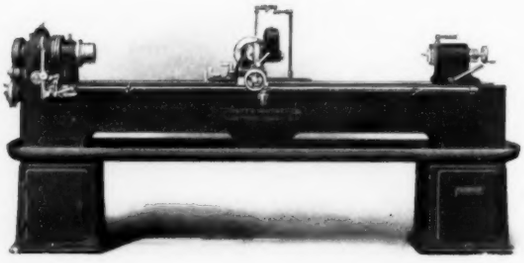
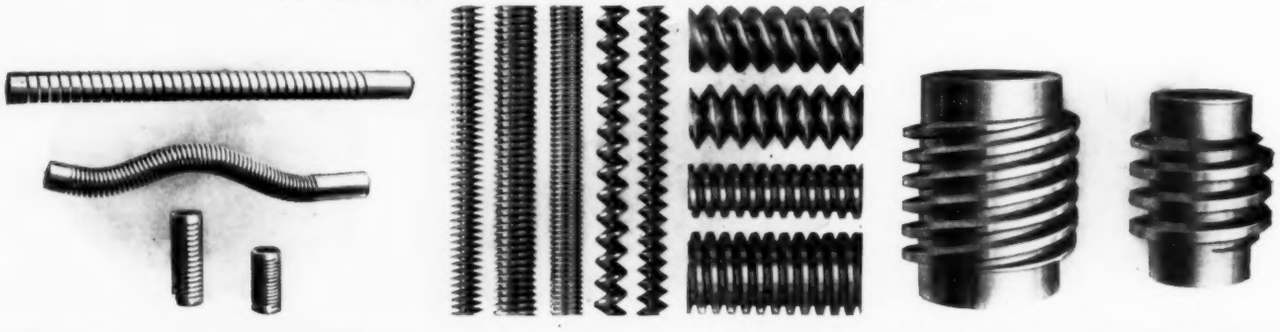


For all the important pc accuracy, finish and cheap the MILLING MACHIN left the LATHE hopelessly behind.

Solid End Springs, Screws and Worms Cut on the Thread Milling Machine.



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Some Gaging and Measuring Methods at the Works of the Westinghouse Machine Company.

EDITORIAL CORRESPONDENCE.

The basis of all shop gaging done at these works is an eight-foot Pratt & Whitney measuring machine with which standard exact inch rod gages have been made as required until the works have a complete set of whole inch lengths up to 80 inches. These rods are used for adjusting caliper gages shown in Fig. 1, all of which, except the micrometer heads, are home made. In making these calipers a good deal of care is given to obtaining exact alinement of the micrometer head and the anvil screw, but otherwise they are of every-day workmanship. The anvil screw has considerable range of adjustment and the calipers shown as having an I-beam section of yoke, which form a set by themselves, give thus a range from 10 to 40 inches by the following intervals:

NO.	INCHES.
1	10—14
2	14—18
3	18—22
4	22—26
5	26—30
6	30—35
7	35—40

The anvil screws have bastard threads, 10 per inch, tho Mr. Thomas, to whom these gages are due, thinks that were he to make the set again he would make the pitch 20 per inch instead of 10. As these screws are used only for adjusting the instruments so that the micrometer heads will read zero for even inches, they are of ordinary lathe cut accuracy only. The holes in the yoke ends for these screws are not threaded but are bored a neat sliding fit, the nuts being half nuts only and arranged to be clamped to the screws or quickly disengaged by turning a nurled nut recessed into and projecting through the web of the I-section. This, of course, saves a lot of traversing of the screw when it has to be moved a considerable distance. The yokes are made of zink-aluminum alloy and are surprisingly light. The mixture is of 30 parts zink to 70 aluminum, and the castings were made in the brass foundry of the works without difficulty.

For delicacy of action a caliper gage must of course be stiff. When made of steel or iron, however, increase in capacity involves rapid increase of weight and, while the stiffness is a necessity, the weight is objectionable because it dulls the sense of touch. The lightness of these instruments is such that the largest sizes may be handled by one man with perfect ease and in connection with the appliances to be described the gaging of the largest shafts is done by one man and of course with far greater satisfaction than would be possible with two men on opposite sides of the shaft being gaged. Those whose experience is limited to caliper gages of steel or iron can hardly appreciate the advantage which decreased weight gives. The calipers are handled with one hand and the contact of the measuring points with the piece being gaged is felt with the same delicacy and certainty that is customary with smaller work.

The method of using these instruments is unique and is shown in Figs. 2 and 3. Fig. 2 shows Mr. Thomas in the act of adjusting the largest caliper. An end measure rod surrounded by a wood case is shown supported in a vertical position by a stand having a heavy base. Clamped to the upright of the stand is a support for two helical springs which support a stirrup having a hole through its center through which the anvil screw of the caliper is passed. The springs hold the anvil screw in gentle contact with the lower end of the end measure rod, which in this case is 39 inches long, and by adjusting the anvil screw the micrometer head is quickly made to read zero when the micrometer head screw contacts with the upper end of the end measure rod. Should the desired size be a few thousandths above the even inch dimension for a force fit or a few thousandths below for a running fit, or should it be desired to add any fraction of an inch to the length of the end measure rod the required amount is added by the graduations of the micrometer head, when, after clamping the head, the instrument is set for use.

Fig. 3 shows the actual gaging of a 30-inch shaft in the lathe. Two light sling chains will be seen to surround the shaft and to support a pair of springs similar to those of the end measure rod stand, these springs again supporting a stirrup which holds the anvil screw in contact with the shaft to be measured as the previous one held it against the end measure rod. Held in this way and with the extreme lightness of the yoke, the gaging may be done as shown and with the highest degree of satisfaction.

The reader will not fail to note that all uncertainties regarding deflection of the instrument by its own weight are eliminated by its method of support. Its position is the same—vertical—when being adjusted as when being used and the support is at the same point. Within the set of calipers which have been described two others will be seen which are made of sheet aluminum instead of alloy and which by reason of their extreme lightness are

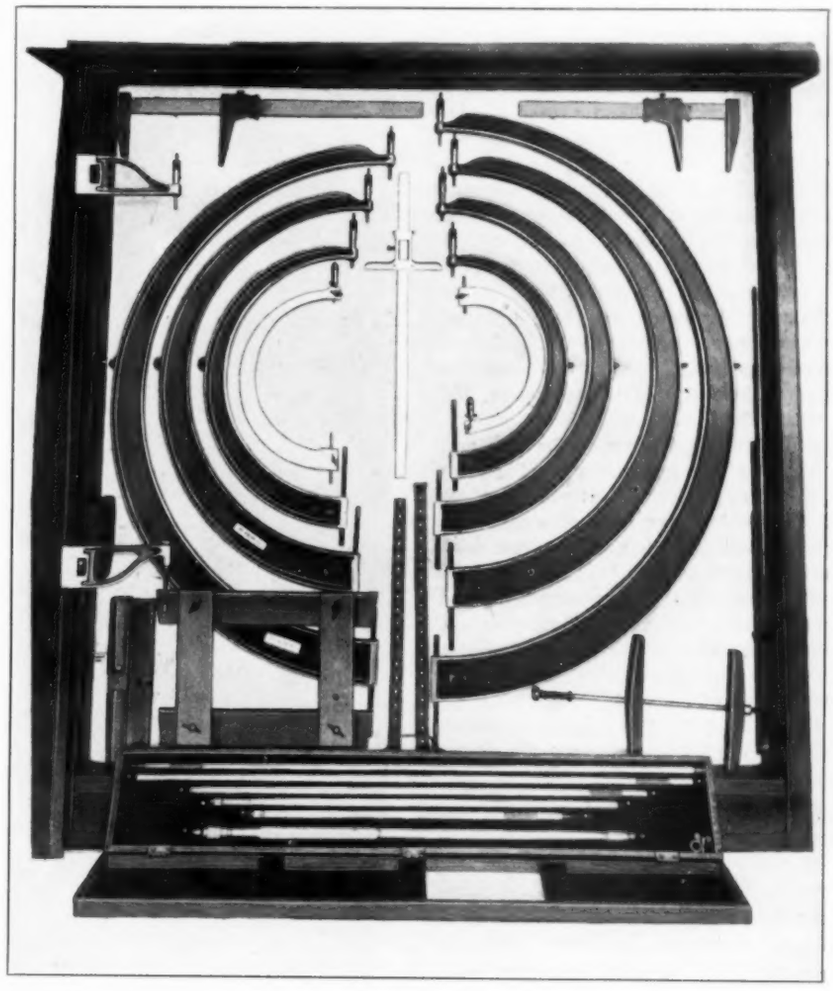

FIG. 1. INSPECTOR'S SET.

found to be more sensitive than others. The one on the left is shown arranged for gaging bored holes, the yoke being very convenient for this class of work, as the instrument may be used with the boring bar still in place.

At the left is a cheap but very effective instrument for use in gaging such pieces as pistons for which the full depth of yoke is not needed. The beam is of wood and the sliding heads of zink-aluminum alloy as with the full yoke form. In this instance the heads were first made of bronze but their weight caused them to be discarded without fitting them up.

On the floor below the large case will be seen a set of Starrett inside micrometers, with a full outfit of extension pieces. These are of course used for gaging holes.

In the lower right-hand corner of the large case is an appliance for gaging T-headed shrink links for securing flywheel segments. Fig. 4 shows roughly two segments of such a wheel, the faces *a* being machined. The spring *b* on the bolt *c* clamps the jaws with sufficient firmness to hold them in position and an inside micrometer *d* quickly gives the distance between the faces, from which the deduction of the specified number of thousandths for the shrinkage allowance gives the length of the link.

Resting on the bottom of the case and to the left of the center is a peculiar gage for the seats of double beat poppet valves which should be not only of the correct diameter and taper but also correct with relation to one another. The sharp taper of the gage will be understood from the fact that the bores for which they are intended are for the insertion of additional or "false" seats on which the valves act. The method of using this gage is shown in Figs. 5 and 6. The upper seat is first bored until the upper gage bar—detached from the remainder of the gage—fits it as shown in Fig. 5, the upper edge of the gage bar being flush with the faced seat *a* of the casting. This seat bored, the parts of the gage are assembled, the connecting pins being a snug fit in the holes, and the lower seat is bored until the upper gage bar again fits the upper seat, the lower one fitting its seat also as in Fig. 6, when the relation of the two bores is obviously the same as that of the two gage bars.

Standing vertically on the bottom of the large case and near the center, Fig. 1, are two carefully made strips of steel each with an up-turned end and with a row of holes down the center spaced one inch apart. These are for use in gaging taper pieces for forced fits, for in the Westinghouse Machine Company's works many forced fits are taper, the taper used being approximately 1-16 inch per foot measured on the diameter. Fig. 7 shows the method of using these strips in connection with an inside micrometer, the taper being greatly exaggerated. The measurements are not made perpendicular to the axis but to one side of the bore. One point of the micrometer being held by a hole in the strip, the other is manipulated precisely as tho the bore were straight as indicated by the dotted arc, and the frequent spacing of the holes in the strip enables the bore to be tested for uniformity of taper throughout its length. The dimension used measured in this way is the one given on the drawing as the true diameter—the microscopic difference between the dimension as called for and as made being obviously of no importance.

Mr. Thomas has much simplified the gaging of these taper holes by a slight and otherwise unimportant change from the former taper of 1-16 inch per foot. With the miscellaneous lengths to which holes are made the 1-16 inch per foot taper leads to awkward decimals for the diameter of one of the ends and for most of the intermediate inches. Thus a hole of 10 inches diameter at the large end and having a taper of 1-16 inch per foot will have the following diameters at successive inches of length when carried out to four places of decimals:

10.
9.9948
9.9896
9.9844
9.9792
9.9740
9.9688

By changing the taper to .005 per inch (1-16 inch per foot is equal to .005208 per inch) the values become:

10.
9.995
9.990
9.985
9.980
9.975
9.970

The change in the taper thus gives round figures for each inch of length and the second set of figures is obviously much more easily read from the micrometer than the first and, by subtracting from the large diameter half as many thousandths as the

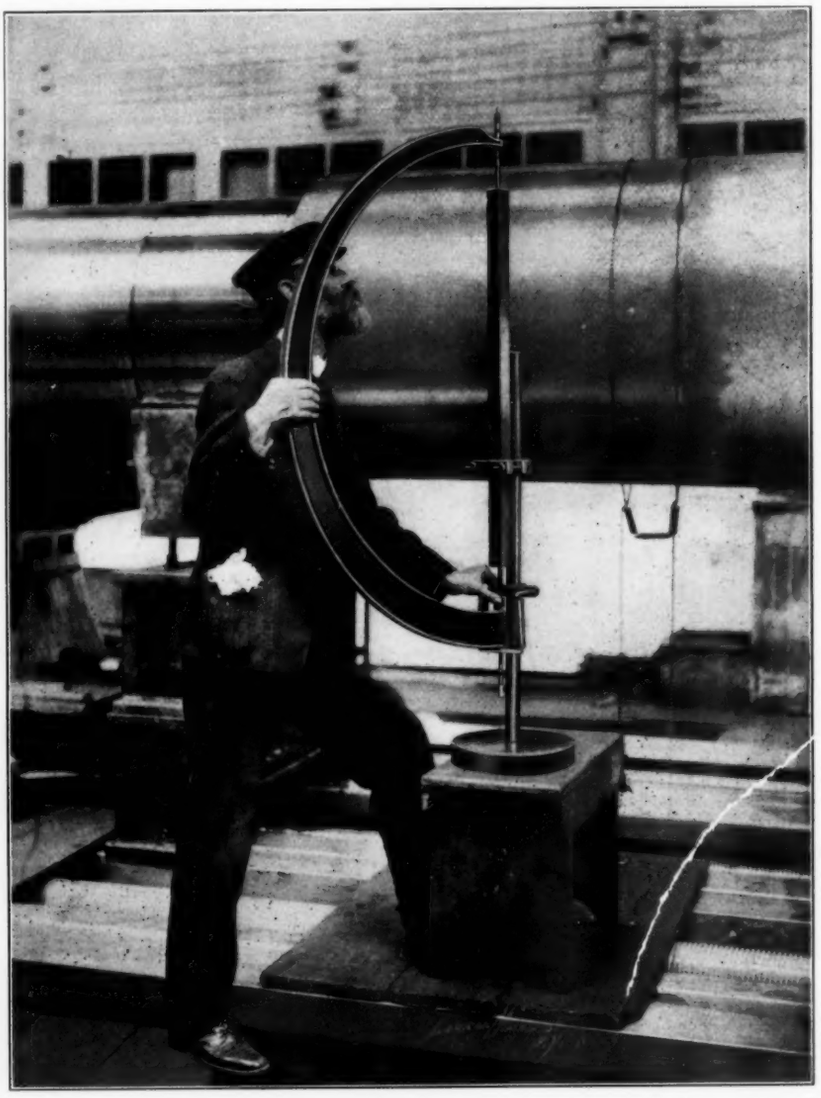

FIG. 2. ADJUSTING A LARGE MICROMETER CALIPER.

piece has inches of length, the small diameter is obtained directly, whereas with a taper of 1-16 inch per foot the small diameter can, in most cases, be found only by calculation.

One advantage of the taper forced fit is not recognized as often as it should be. With a parallel fit the holes can be compared only by gaging, whereas with the taper fit the plug may be entered in its seat and the two compared, the distance plug. They are, of course, much lighter than full plugs and with them the holes can be gaged independently on different diameters while irregularities in the holes are more easily detected.

Fig. 9 shows a very simple method of testing the accuracy of the pitch of taps. The upper view shows that the half nut has but two threads and by laying the tap in the half nut in two positions which by the supposed pitch should be an inch apart

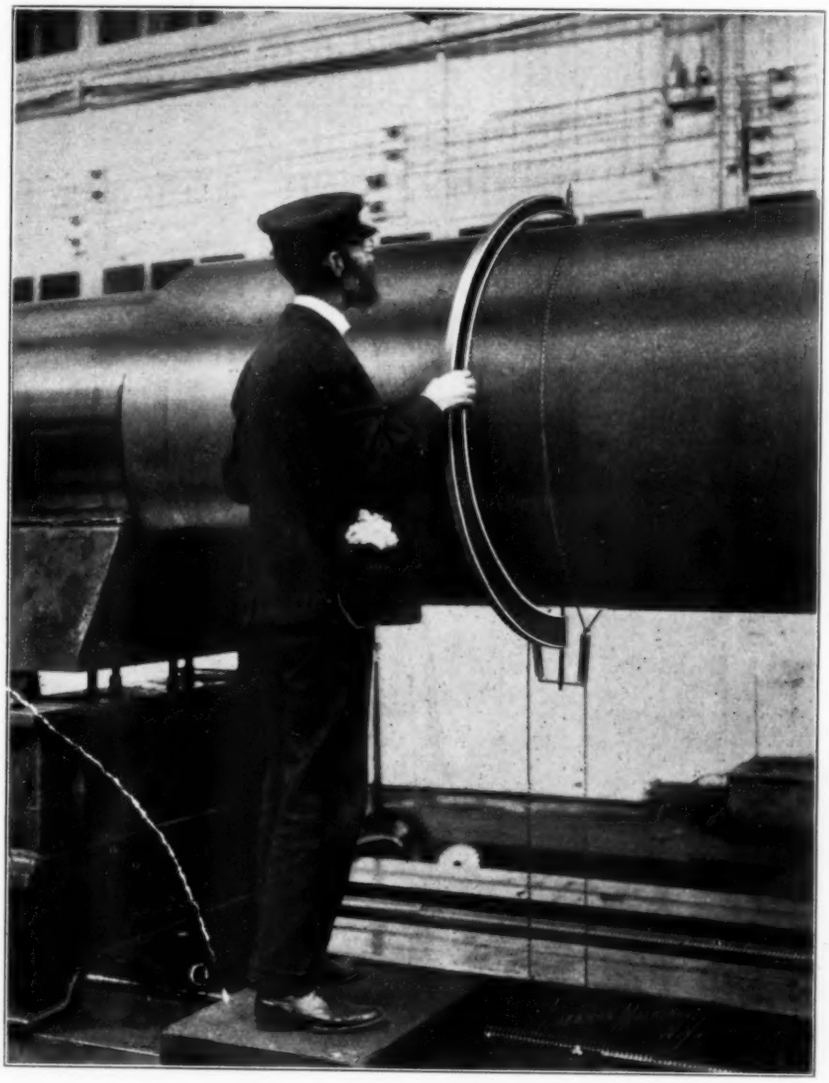

FIG. 3. GAGING A LARGE SHAFT.

remaining for pressing home when the parts come to contact forming the best possible check upon both. Thus with a taper of .005 per inch and an allowance of .01 for pressing the plug should enter the hole within two inches of going home. The adoption of the .005 inch taper simplifies this relation as well as the gaging, as by using this taper the number of inches by which the parts should not go home when assembled is one inch for each five-thousandths of pressing allowance.

Fig. 8 shows a form of gage for smaller taper holes, such as those for crosshead pins, which Mr. Thomas prefers to a full and then measuring the distance with the micrometer head the error may be found and measured.

Mr. Thomas finds, as others have found, that with the best outfit of gages the old-fashioned calipers still have their place and Fig. 10 shows such a caliper of large size and made of sheet aluminum. This instrument has a capacity over a full circle of 65 inches and its weight is but 8½ pounds. Mr. Thomas calls it an articulated caliper from the construction of the contact ends. These are jointed to the jaws so as to present faces squarely to the work and one of the contact points is adjustable by a fine nurled head screw—this screw being used for the fine adjustment of the instrument. F. A. H.

Education and Training of the Japanese.

All the world is interested in one way or another in the war now going on between Russia and Japan, and while there were some who, being well acquainted with affairs in both countries from the inside, expected some such result as has thus far manifested itself, most of us have been and are greatly surprised at the practically uniform success of the Japanese, in the practise of an art which up to a few years ago they were entirely ignorant of, and in which they are contending against a nation generally supposed to be thoroughly versed in and well equipped for the practise of that same art. It is simply the latest astonishing thing to be done by a people who have been continuously astonishing all the rest of the world ever since Commodore Perry convinced them that the rest of the world was worthy of their attention. It is curious and interesting to note that a prominent newspaper, the editor of which is given to thinking and is undoubtedly thoroughly well qualified to speak of educational matters, seems to ascribe the success of the Japanese to their lack of what is called practical education, or rather, to the fact that they, having for many generations confined their efforts to the acquirement of an entirely different kind of an education, were thereby making the best possible preparation for the full use of modern scientific and technical knowledge. Reading between the lines we can see readily enough that if the views of the writer are correct, they have a bearing upon other arts than that of war. We reprint an editorial which appeared in *The Evening Post*, of New York, April 20, under the title of

JAPAN: A PARADOX IN EDUCATION.

A certain condescension with which military critics have been congratulating Japan upon her successful application of our teachings is changing to an uncomfortable sense that we Occidentals are every day learning hard lessons from Japan. The demonstration of the efficacy of unarmored vessels, the successful operation of contact mines as a means of offense, add new chapters to naval theory, and we may not lightly flatter ourselves that these formidable inventions are merely the obvious application of our teachings. No; this remarkable mastery of the machinery framed by the Western mind denotes not simply that the Japanese have caught up with us and surpassed us in a single generation of conscious imitation: it means rather that in feudal Japan there were qualities of mind stable enough to bear the impact of new facts and accurate enough to master them. The successes of Japan to-day in scientific warfare are due to that immemorial discipline of hand, heart and head which has made the Japanese mind.

To those who cherish conventional ideals of education it may be instructive to ask what that education was. And immediately we meet the paradox that the training which is every day producing practical results of the most sensational kind was the most impractical that may be conceived. The heart was trained by rigorous subjection to the most exacting of social codes, the hand by devotion to minute and exquisite workmanship, the head by poetry, romance and speculative philosophy. Were a British schoolmaster asked to construct a scheme which should totally unfit his students for practical affairs, it would not differ greatly from the Japanese plan. Among the upper classes the earliest training is in calligraphy, and the control of the ideographic script makes every educated Japanese an artist in the handling of the brush. The artisan class gets a similar schooling in trades which are all conducted with the patience of the ivory carver, or the designer in lacquer. Against this perfectly trained hand the West sets a hand numbed and almost superseded as an instrument of precision by the machine. For that check upon lawless emotionalism which a fixed social etiquette provides, the West offers individualism; that is, the caprice of the unschooled man.

But the two disciplines of fine craftsmanship and fine manners are, after all, secondary, else a legion of watchmakers and dancing masters might conquer the world. What has really made the Japanese mind the superb instrument it is daily proving itself to be is the habit of abstract meditation—of separating the operations of the intellect from those of the emotions. For some two thousand years the best minds of Japan have had the habit of hard and consecutive thinking along metaphysical lines. The generalizations which fix the individual's relation to society have been no more carefully pondered than the relations which exist between the individual and the cosmic order. It is common to condemn this stagyrite attitude. The West to-day lets the sleeping dogs of philosophy lie, and turns to science and engineering. From the China seas comes the startling message that your best engineer comes of generations of mystics, that by a strange perversion the soul of Siddartha is controlling with a precision before unknown the weapons forged by Thorneycroft and Krupp.

If there is anything to learn from this paradox, it is the value of mind stuff in all its phases, the folly of off-hand opinions on national superiority, the fallacy that infects the so-called practical education of to-day. It is wholesome and fortifying to recall that all hard-thinking is potentially practical. Larger tolerance comes from the thought that intellect is not necessarily wasted because it does not emerge thru the conduits of our particular national or racial activities. Some of the best thinking of the world was done by the schoolmen. St. Thomas Aquinas, perhaps, might have marshalled armies with the precision displayed in the "Summa"; it would have been no more surprising than the patient planning and actual execution of the present naval campaign by the offspring of the Samurai, with their code of honor more tortuous than any theology. No hasty generalization as to the inferiority of yellow races can obscure the fact that, measured only by skill in handling the latest machinery of civilization, the Japanese appear as the superior, the Russians as the inferior race.

Broadly considered, the significance of great tacticians bred on calligraphy and metaphysics, seems to be that the intellect finds its account in a great variety of edu-

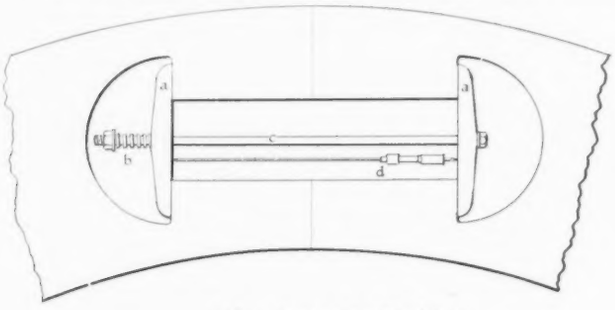

FIG. 4 Gaging a Fly Wheel Joint for the Shrink Link

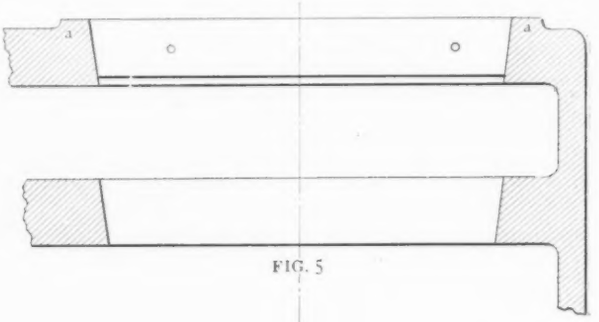

FIG. 5

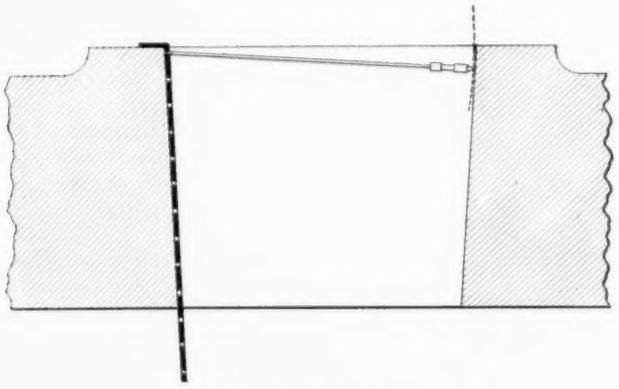

FIG. 7 Gaging a Taper Hole

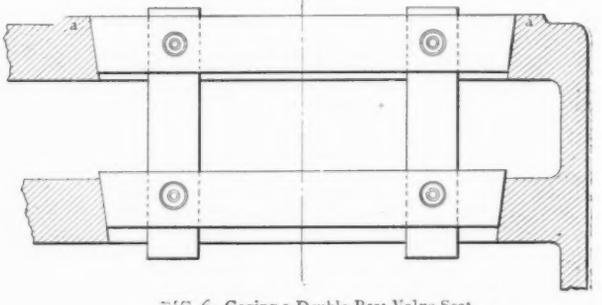

FIG. 6 Gaging a Double Beat Valve Seat

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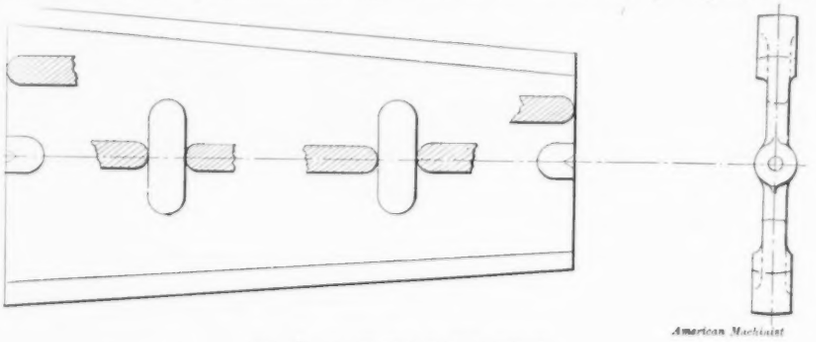


American Machinist

FIG. 8. GAGE FOR TAPER HOLES.

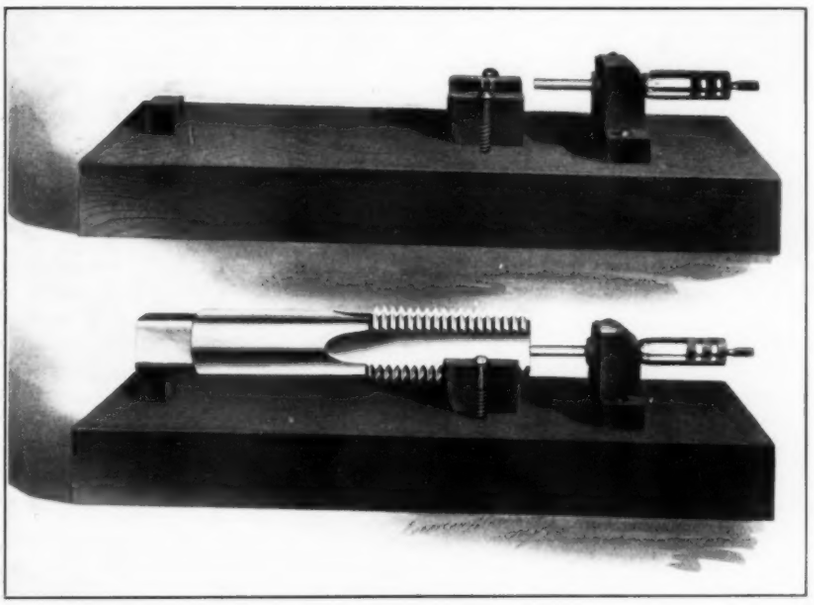


FIG. 9. GAGING THE PITCH OF TAPS.

cations, and prevails even over the worst. And, more particularly, the ease with which scientists, engineers, naval and military experts have been produced in Japan proves that often the most abstract training is the best preparation for practical efficiency. The cherry-stone carvers have been preparing to hold the lever and the trigger; the pundits have found the plotting of a campaign upon Port Arthur already accomplished in their ancestors' charting of the cosmos and the soul of man. The Japanese have not been taught to despise anything as too small or too great. No illusion of racial superiority has fostered a faith that they can blunder luckily thru all emergencies. No superstitious respect for machinery has betrayed them into scorning the finest of all instruments—the mind itself. Their success is a warning to them not too readily to give up the educational standard under which they are conquering, and a reminder to us not to substitute workshops and sham practicalities for the old liberal training that makes the mind hardy enough to meet the most exigent practical demands.

We have already quoted some interesting passages from the articles of a "special commissioner" of *The Mechanical Engineer*, of Manchester, who attended the joint meeting of engineers in Chicago. In the latest number of our contemporary at hand he tells us of his visit to Cincinnati, situated, he says, on the "River Ohio." He had a good time there and saw lots of things that interested him and stimulated thought. As an evidence of this we find that he has discovered a secret which he tells us about as follows:

"I have often wondered how it was that American tools seemed so 'natty' compared with ours. The secret lies in their making one type of machine only, enabling them to attend to the little details, such as oil holes, handles, making all the nuts usually adjusted so that one key fits them, etc., with greater thoroughness than is possible where fifty different types of machines are made."

This is very interesting, but it would probably surprise our friend to be informed that there are a few facts familiar to those who know the American machine-tool industry, which facts completely upset his theory. He will have to guess again.

W. B. Ward, of Richmond, Ind., sends us what he calls a "Book Puller," and states that he has used it to good purpose in removing bound volumes of the AMERICAN MACHINIST and other heavy books from book shelves where there was no opportunity to get hold of them by ordinary means except by the backs, which, as we all know, is a destructive process. This puller reaches over the top of the volume and the blade at the end is curved to fit the edges of the leaves and the volume is tipped forward.

FIG. 10. A LARGE ARTICULATED CALIPER.

Notes From the Pratt & Whitney Shops.

EDITORIAL CORRESPONDENCE.

PRECISION FORGING.

Lying before me as I write are three small forgings which are striking examples of what may be done by the blacksmith shop toward simplifying finishing operations in the machine shop. The forgings are pretty clearly represented by the half-tone Fig. 1 (which has been made directly from the pieces themselves and not from retouched photographs) and, as will be seen, are blanks for a screw machine chuck, a pair of bench-lathe collets forged in one piece, and a small tap wrench handle.

Along with a considerable variety of comparatively small parts, these forgings in various sizes are being produced in large numbers at the Pratt & Whitney shops, and so closely to size and with such a perfect surface is the forge shop turning them out that the portions requiring accurate sizing are readily finished in the grinding machine without preliminary roughing down operation in the lathe. Of course such parts as spring chucks, etc., require a certain amount of lathe work such as boring out and threading; but, so far as the plain outside surfaces are concerned, these are attended to wholly by the grinders. In the case of centers for 13- and 14-inch lathes, these are not even touched by a lathe tool, the grinder finishing them complete from the forging.

The forgings of this character are all made to gages which allow from six to eight thousandths of an inch for finishing. The work is done under Bradley hammers equipped with upper and lower dies, and as the stock is turned in the impression in the lower die by the operator a fine spray of water striking the die faces keeps the piece free from scale and, as a result, the forging upon leaving the die has a wonderfully smooth surface. Moreover, the work thus produced is surprisingly accurate; for example, the double-ended collet forging shown in the engraving measures with the micrometer less than 0.002 inch out of round, and is tapering by only a slightly greater amount.

Spring chuck or collet blanks for turret lathes and thread millers are forged in this manner up to 3⅜ inches diameter by 4 inches long, this size being turned out with the same degree of accuracy as the smaller ones. The lathe centers mentioned are, in the larger size, forged about 7½ inches long over all. Tap wrench handles like the one illustrated and arms for turret lathe pilot wheels are forged in different lengths up to 20 or 22 inches; and while such handles form naturally a different class of work from bench lathe and turret machine chucks, the forgings are by this method produced quite as accurately as the chuck blanks and with the same elegant surface.

FINISHING SPRING CHUCKS.

The lathe collets—which are hardened only on the head and in the hole at the front—are ground to size on the outside immediately after chucking and threading—that is, before hardening—and, as care is taken not to overheat them, nothing further than polishing the black surface is required to finish the outside. The hole at the front for the stock is of course ground after the piece is hardened and the outside polished. Screw-machine chucks of the type shown are hardened all over, after the forged blanks are bored out, faced at the ends and split, and before any grinding is done whatever.

In connection with the finishing operations on these spring chucks for turret lathe, an interesting little arrangement is used for closing the working end of the split and hardened chuck centrally and for holding it so during the grinding of the outer surfaces. In Fig. 2 is shown at *a* a fixture which receives the chuck, the hole at the bottom admitting the cylindrical part of the body easily and the upper end being bored out taper to receive the conical portion. At *b* is a hardened tool-steel plug which is 1-64 inch under the size the hole in the chuck is to finish, and at *c* is a ring bored somewhat larger than the diameter of the chuck nose and provided with three obliquely disposed screws which may be set up on the short nose or extension at the end of the chuck. The holder *a* with a chuck in place is put in an arbor press and plug *b* and ring *c* are dropped into place. The press ram is then brought down easily, forcing the chuck into its seat and closing it centrally upon the hardened plug *b*, and the three screws in the clamp ring are set up so as to hold the chuck jaws tight to this plug when the chuck is removed from the fixture.

The chuck is now placed between the centers of a bench grinder, the pin in collar *c* serving as a driver, and the parallel portion at the rear end of the chuck is ground to size. Then in another machine with the chuck still closed on the hardened plug the conical end is ground. Next, the chuck is slipped into a grinder spindle nose—which is finished on the inside to the required taper—and pulled back into the conical seat by a draw-in rod with three projections at the end to engage the three holes drilled thru the chuck shell. The ring being removed, the spherical surface at the end by which the chuck is enabled to open and close without moving endwise, is ground true by means of a special grinder head; and then the plug is removed and the hole for the stock ground out to size.

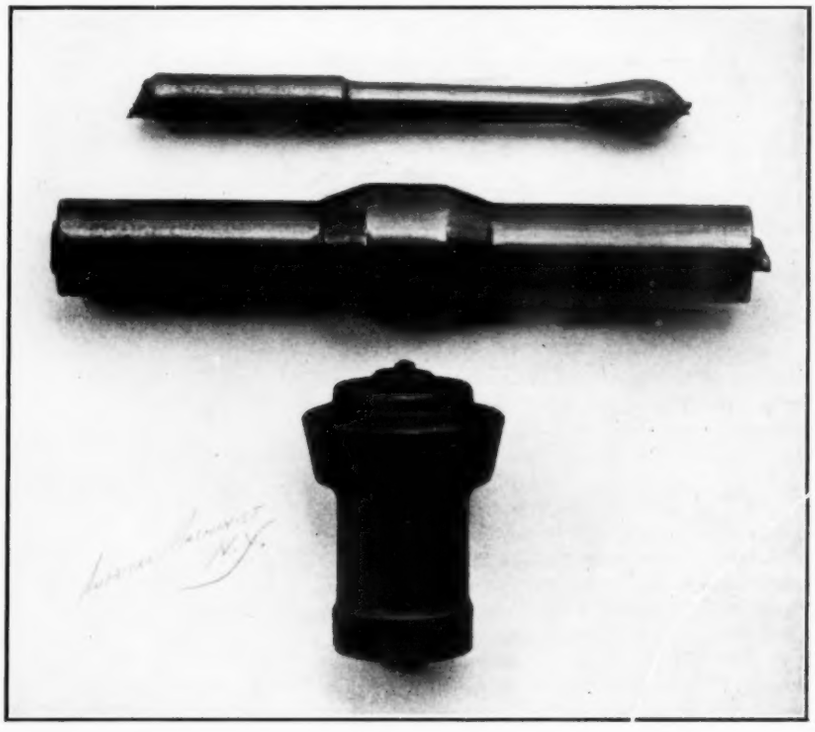


FIG. 1. SOME ACCURATE FORGINGS.

LAPPING PLANER TOOLS.

The planers upon which the Pratt & Whitney Company machine such parts as engine lathe beds, bench lathe beds, and much other work of similar character, are set up on solid cement foundations and, as might be expected, are kept in the best of order, to simplify as far as possible the final scraping operations. On a good deal of the gray-iron work—for example, on the bench lathe beds mentioned—the finishing tool for the flat top is lapped while in position before taking its last cut, with the result that a magnificent surface is produced—one that is so smooth and true that very little work with the scraper is necessary in fitting up the machines.

Six of these small lathe beds may be handled simultaneously on the planer, they being lightly clamped in two rows of three each. When it comes to planing the top surfaces, these are gone over in the usual manner with a roughing tool, the square nose finishing tool is run across under a coarse feed, leaving a good surface on the work, and then the tool is lapped for the final cut. For this operation there is employed a small gray-iron block with top and bottom surfaces parallel and charged on the upper surface with flour of emery and oil. The square nose is set as true as possible, and then a time card is slipped behind the

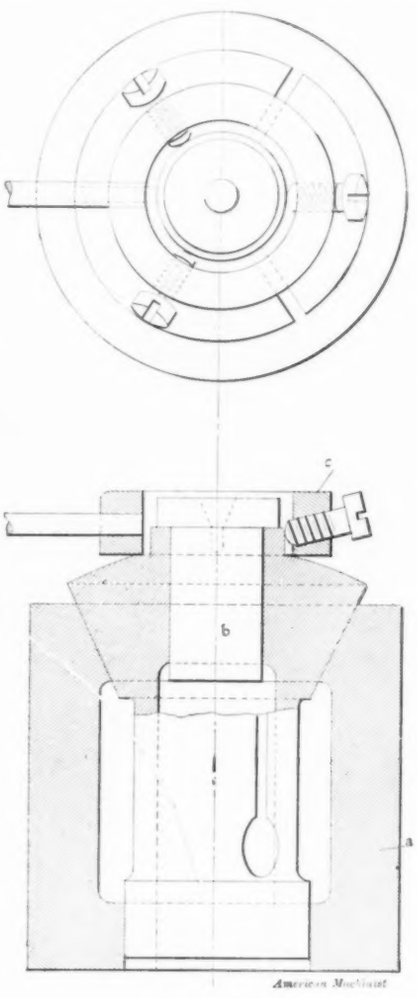


FIG. 2. A SPRING CHUCK FIXTURE.

clapper block to swing the tool out for a slight clearance. The cross-feed handle is turned to move the head in the direction of the feed and remove the back-lash and the tool is then run down to the lap and the latter rubbed back and forth until a dead true cutting edge is secured. The tool, now ready for the scraping cut, is fed across the work, removing something like one and one-half or two thousandths of an inch from the surface, the feed being in the neighborhood of one-half inch, or as coarse as the width of the tool will permit.

Side tools, dovetail tools and others, for important surfaces on gray iron, are also lapped to give them straight cutting edges, this being done before the tools are put in the planer. The lapped tool when carefully set will retain its true edge for a considerable length of time; and will take elegant finishing cuts, and cuts of considerable width; a small side tool which I saw, and which was used constantly for finishing vertical surfaces, being operated regularly with one-half inch feed, and producing a surface quite as good as that left by the lapped square point.

F. A. S.

National Interchange of Men, Methods and Products in Tube Manufacture.

The following interesting information concerning the manufacture of tubing in Great Britain comes from Marshall Halstead, United States Consul at Birmingham. He says, in part:

My interest in tube manufacture was aroused originally by the fact that weldless or seamless cold-drawn tubes, made with exceeding care to meet certain high-grade requirements, were, and still are, shipped to the United States from my consular district. This interest increased when I learned of the engagement and importation by one great British tube company with works near Birmingham of four American workmen, to go on night and day shifts of two each, to take charge of a lap (tube) welding plant built on the "American plan." Besides, when I was in the United States last June I read in the newspapers that this American competition with America had been followed—the newspapers announced that the men were starting for England—by the engagement of four American butt welders for work with another British tube company in a town near Birmingham, also in my consular district, and, strangely, this missionary trip of American workmen seemed to be regarded as a matter for congratulation upon our part.

There has been constant progress in the manufacture of lap and butt welded tubes, increase of speed in making them and very great advancement toward perfection in results, and that these improvements have been largely American is made evident by the fact that not only are new butt and lap welding plants in Great Britain built in imitation of or on American lines, but, as I stated in my introductory paragraph, in one great British tube factory in this district there are four American workmen (two shifts) in charge of the lap-welding plant, and in another tube factory four Americans (two shifts) in charge of the butt-welding plant. These men were brought here from Pittsburg and adjoining tube-making neighborhoods, the lap welders under five- and three-year contracts, the butt welders under three- and one-year contracts, at wages many times greater than the ordinary rate of wages in this district, and, as an inducement to the men to come here, at an advance—not a big one—over American lap and butt welding wages.

Of course the inherent spirit of adventure and the idea so generally held in America, and as generally erroneous, that living is much cheaper in England than in America, influenced these men to come here. There were some disappointments in store for them, but they are fairly happy and content now, though without doubt they are the only workmen in this neighborhood who pay a good big income tax, and of course an income tax was not in their calculation as an offset to their earnings here. They have told me that they cannot live as cheaply here as they could at home; certainly, food is dearer; and clothing even, all articles of wearing apparel for a family considered, they think not as cheap as at home. I really should print some letters I have had from them on the subject. Near one of the works the men were not able to find, at any price, houses with the conveniences they were accustomed to and had thought necessary to their comfort when at home, because there had not been anticipation that men in their position would have an ambition to or could afford to occupy the kind of houses they had thought they required; and they could not go into a better neighborhood—that is, the middle-class neighborhood they could afford to live in—because, working before hot furnaces, they must get indoors, for a time at least, as soon as possible after they had finished their work. The company very kindly complied with one of their requirements—somewhat unusual here—by providing them with a convenient place at the works for changes of clothing.

In the case of one of the plants for lap welding, while it was supposed to have been built on American lines, the furnaces were not satisfactory, the brick lining being a few inches instead of many inches thick (my consulate records show that Staffordshire firebrick was formerly shipped to the United States), and the sand for the bottom of the furnace was not satisfactory, because, taken from the mouth of a river, it contained dirt, while there was need for a pure sand; and the plant was too close to other machinery. Most of these difficulties have been adjusted to their liking. They secured at last a pure sand, and a better brick is used, so that the furnaces are not down as often as originally and they can now make their bonus for output regularly; and I think I am correct in saying that they have tripled any English coal furnace output with one furnace and same number of men—tho it is not as great as they might wish, for recently they have produced more than the company can sell, and they have long lay-offs. The butt welders in the other works found in the new machinery that the American plan had been reversed, so that tubes started fast and then went slower, and therefore did not clear; so by an arrange-

ment with the management, the company's draftsman having been placed at their disposal, they have had to rebuild the plant so that the butt welding can start slow and finish fast. As I have not seen any of them since they completed the rebuilding and had the new plant under way, I have not heard what success they have had.

The St. Louis Exposition—X.

EDITORIAL CORRESPONDENCE.

THE BALTIMORE & OHIO EXHIBIT OF OLD LOCOMOTIVES AND REPRODUCTIONS CONTINUED.

The next engine shown, "Old Ironsides," Fig. 17, is of special interest to American readers, by reason of its having been the first to bear the name of Baldwin. This engine dates from 1832, and was remarkable because of its construction rather than because of any novelty in its design, as it was not markedly different from Stephenson's "Mercury" of 1830. When we consider the then entire absence of facilities for doing work of this character in Philadelphia and of mechanics acquainted with any work comparable with it, we can understand the real merit of its production. Thus the cylinders were bored with a tool fixed in a block of wood and turned by hand. Baldwin had to devise most of the methods of doing the work and do much of it himself. The engine was built on order from the Philadelphia, Germantown & Norristown Railroad, the order having been given because of the successful working of a miniature model which Mr. Baldwin had made for a museum in Philadelphia in 1831. Of this reproduction, the name-plate, the number-plate and one of the levers are from the original "Old Ironsides," and these form the only parts of that engine which are known to exist.

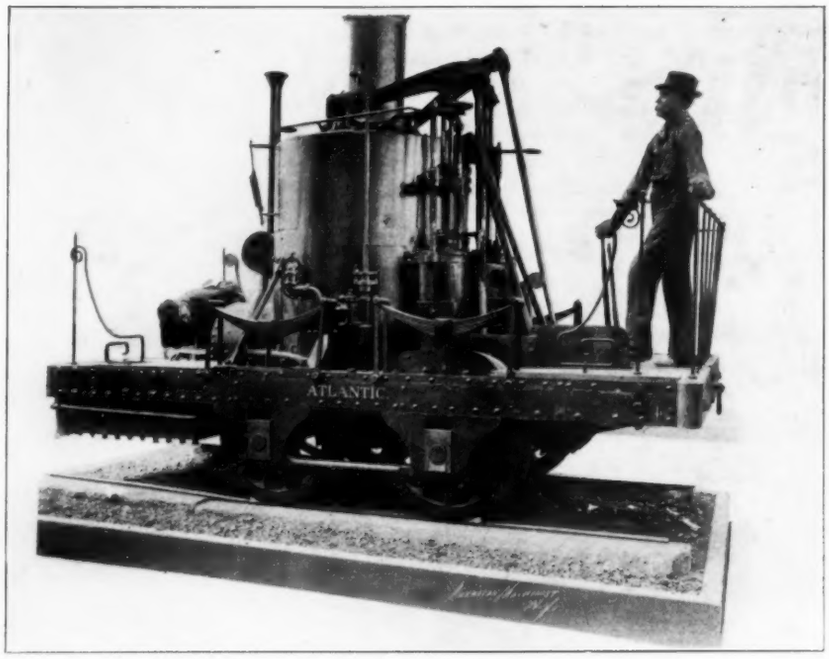


FIG. 18. THE "ARABIAN"—1832. THE OLDEST NOW IN EXISTENCE IN AMERICA.

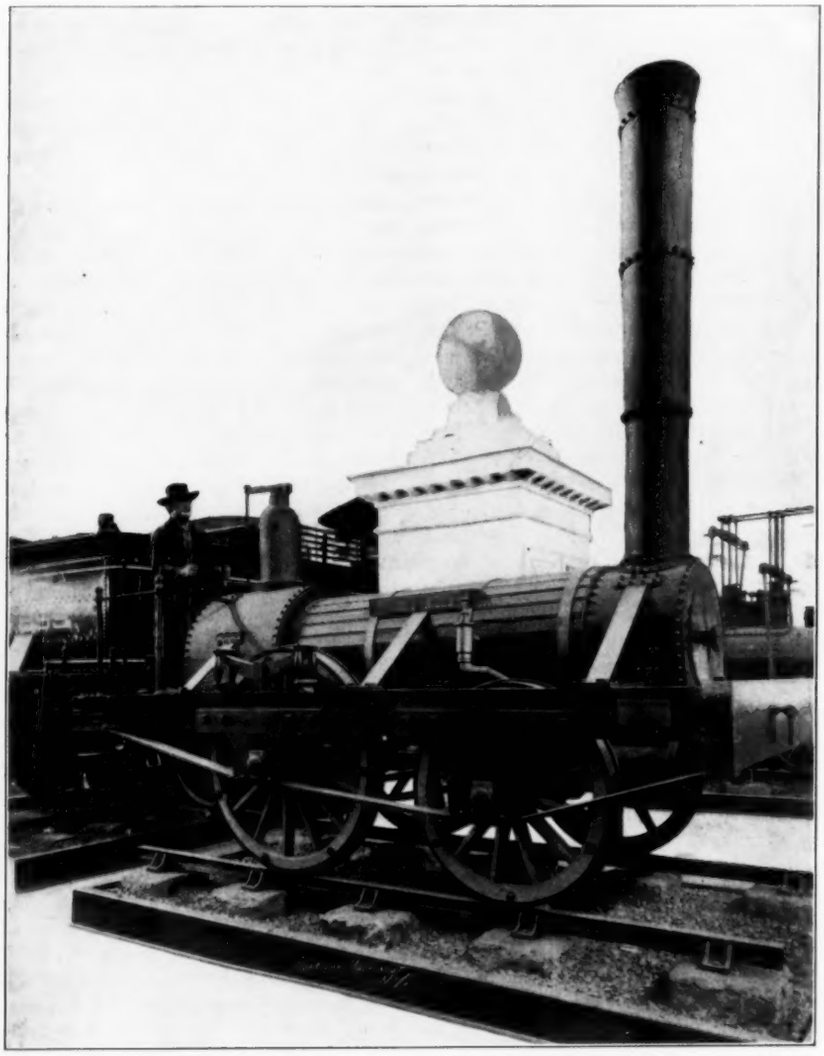


FIG. 17. "OLD IRONSIDES"—1832. THE FIRST BALDWIN.

Remembering that "Old Ironsides" was not in any important particular different from the "Mercury," the illustration of the former will show the remarkable advance made by Stephenson between 1829 and 1830. The illustration of the "Rocket" of 1829 shows that it had no frame in the modern sense—the cylinders being attached to the boiler, which latter thus did duty as a frame member. In the "Mercury" of 1830 there appeared the combination of inside horizontal cylinders located under the smokebox, a cranked axle and a frame connecting the cylinders with the driving boxes, while the spring support of the "Rocket" was retained. These features were mutually interdependent. The horizontal cylinders under the smokebox were necessitated by the cranked axle, while this location led naturally to the frame, and the fact of their being horizontal made spring suspension practicable. While Ericsson's "Novelty" of 1829 had the cranked axle, its cylinders were vertical, the crossheads being connected to the connecting rods by bell cranks and links.

If such a combination of desirable feat-

ures does not constitute engineering, then the word has no meaning. Hackworth, who was Stephenson's chief competitor, attached the cylinders to the boiler at least as late as 1839 (see Fig. 26), and as late as 1838 (see Fig. 25) he placed them in the worst possible position—the vertical. In this country, too, the cylinders were attached to the boiler as late as 1837 (see Figs. 23 and 24), while the horizontal position for the cylinders was not generally accepted for several years thereafter. The more Stephenson's work is studied the more it must be admired.

Another engine dating from the same year as "Old Ironsides" is shown in Fig. 18, the name "Atlantic" appearing in the picture. It is now known, however, that this name is erroneous and that the original name was "Arabian." The original engine is shown at St. Louis, and is the oldest American locomotive in existence and the only pioneer engine on American roads of American construction in its original form. It was not taken out of service until 1893, its active life covering thus a period of sixty years, which is believed to be an unequalled record. In this, as in many of the early Baltimore & Ohio locomotives, there is a geared connection between the engine shaft and the driving shaft, but, unlike the first efforts in that direction, in this case the gears are arranged to increase the speed.

Except for the "Johnson" there is nothing noteworthy about these early American engines beyond the fact that they were pioneers, as the others introduced no new principle of construction which endured and, excepting the "Old Ironsides," they were clearly inferior to English engines of the same date. With the next illustration, however, there begins another story.

In Fig. 19 we have the "James" of 1832, by Wm. T. James, of New York, which is noteworthy as being the first to have a link motion,* which, it is now established, was invented by James some twelve or fourteen years before its use by Stephenson. The engine saw service on the Baltimore & Ohio up to 1835, when it was transferred to the New York & Harlem Railroad and shortly afterward exploded its boiler. The link was used for reversing only, the reverse lever being vertical when in its mid-position and held in the two extreme positions by a weight. The suitability of the link for expansive working was discovered by accident by Samuel B. Dougherty, who was James' foreman, the discovery being made while adjusting and setting valves.

Perhaps no improvement in the locomotive was of slower adoption than the link. Included in this exhibit is the "Pioneer," built by Baldwin in 1848 and the first locomotive seen in Chicago, and it is fitted with the gab hook motion which, indeed, continued to be made for many years thereafter.

Next we have the "South Carolina," Fig. 20, by Horatio Allen, which dates from 1832, and was in many respects a remarkable engine. It was built at the West Point Foundry, and it is obvious at a glance at the illustration that it was of far greater power than most engines of its time. Moreover, it introduced the Farlie principle, which has found considerable use in Europe and it foreshadowed the bogie truck. The engine had a long, double boiler with a single firebox and rode on two trucks which were arranged to swivel in order to accommodate curves, as all trucks do now. Each end had a single cylinder under the smokebox, the swiveling of the truck being taken care of by looseness in the crosshead and crank pins.

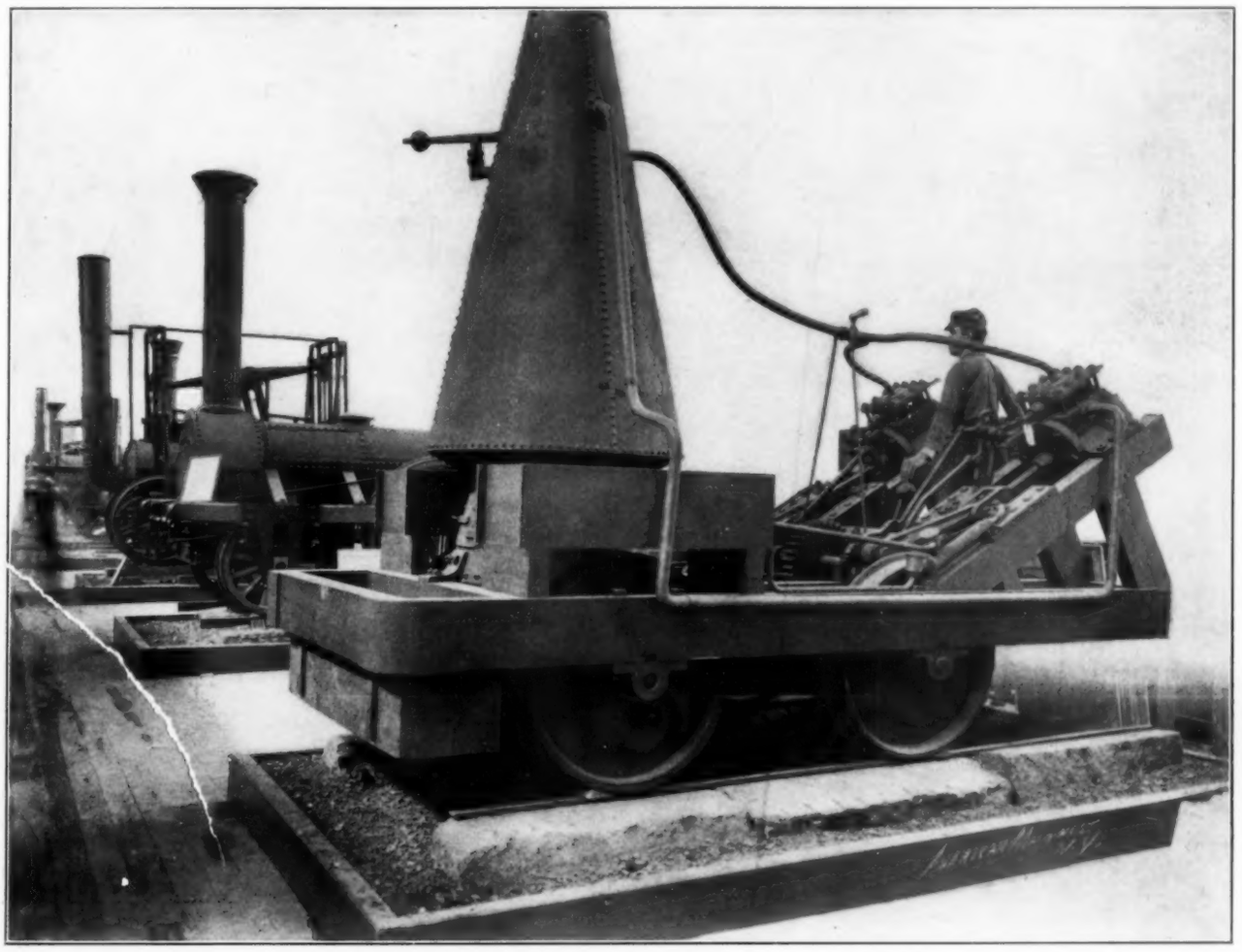


FIG. 19. THE "JAMES"—1832. THE FIRST TO HAVE LINK MOTION.

* The statement in a previous article that the first appearance of the link motion is not represented at St. Louis grew out of the fact that when that article was written many of the placards which identify the exhibits were not in place. This was true of the "James," and the significance of that engine escaped detection in consequence.

The same year saw the production of the "Experiment," Fig. 21, by John B. Jervis, of New York, in which the full-fledged bogie truck appeared. Jervis was chief engineer of the Mohawk & Hudson Railroad, where the "De Witt Clinton" had been tried the previous year, and, like all the other American pioneers, he was impressed with the unsuitability of the rigid wheel base of English engines for the crooked tracks which were, and are, imperative by the conditions in this country, and he designed the "Experiment" in order to meet these conditions. Like so many of the other early engines, this one was also built at the West Point foundry. It had a record of 14 miles in 13 minutes and of a single mile in 50 seconds. The bogie truck is obviously there, complete and perfect.

We next come to the "Mississippi," Fig. 22, which was built in England in 1834 and placed in service between Natchez and Hamburgh, Miss., in 1836. It saw its last service in the year 1890-91, and there is considerable uncertainty regarding how many alterations it may have been subjected to. It would be especially interesting to know the history of the cab which this is the oldest engine to show. It may, of course, have been added long after the engine was built, and it is obviously arranged with a view to the Southern climate. It seems quite probable, from this engine, that the cab was originally added as a protection from the Southern sun rather than from the Northern snow and sleet. In its arrangement of cylinders and wheels, this engine is strikingly modern, but whether this was the original arrangement is uncertain.

Another famous engine of that day is the "Lafayette," Fig. 23, built by Wm. Norris, of Philadelphia, in 1837. This was one of three, and was the most famous locomotive of its time. A duplicate, the "Washington," performed what had been believed to be impossibilities in climbing grades on the Baltimore & Ohio. The success of these engines was so great as to lead to an order from England for an engine for use on the Lickey Incline of the Birmingham & Gloucester Railway, where chain or cable traction had been used. The engine built to fill this order was the "Philadelphia," which was the first American locomotive to be exported, and which was so successful that five more were ordered and the cable system was abandoned upon this incline. A large demand for Norris engines continued in Europe, and eventually led Mr. Norris to establish himself in Austria, where he built the Royal Works at Vienna.

In the "Lafayette" we see the typical American engine beginning to take shape, for here are the bogie truck, the outside cylinders and the bar frames. The secret of its greater tractive power appears to lie in the location of the driving wheels in front of the firebox. Baldwin engines of that date had their driving wheels behind the firebox, and of course with the Norris arrangement these wheels carried a greater percentage of the total weight than they did in the Baldwin position.

In Fig. 24 we have another historic engine, the "Hercules," built in 1837 by Eastwick & Harrison, of Philadelphia. The "Hercules" was notable because it was the first to have that distinctive feature of American locomotives, the equalizing lever—a feature which made possible, with the then construction of American tracks, an increase of weight to 15 tons, which was considered enormous. Because of this weight, it was freely predicted that the engine would not turn curves nor go through switches, but these forebodings of course proved groundless. As

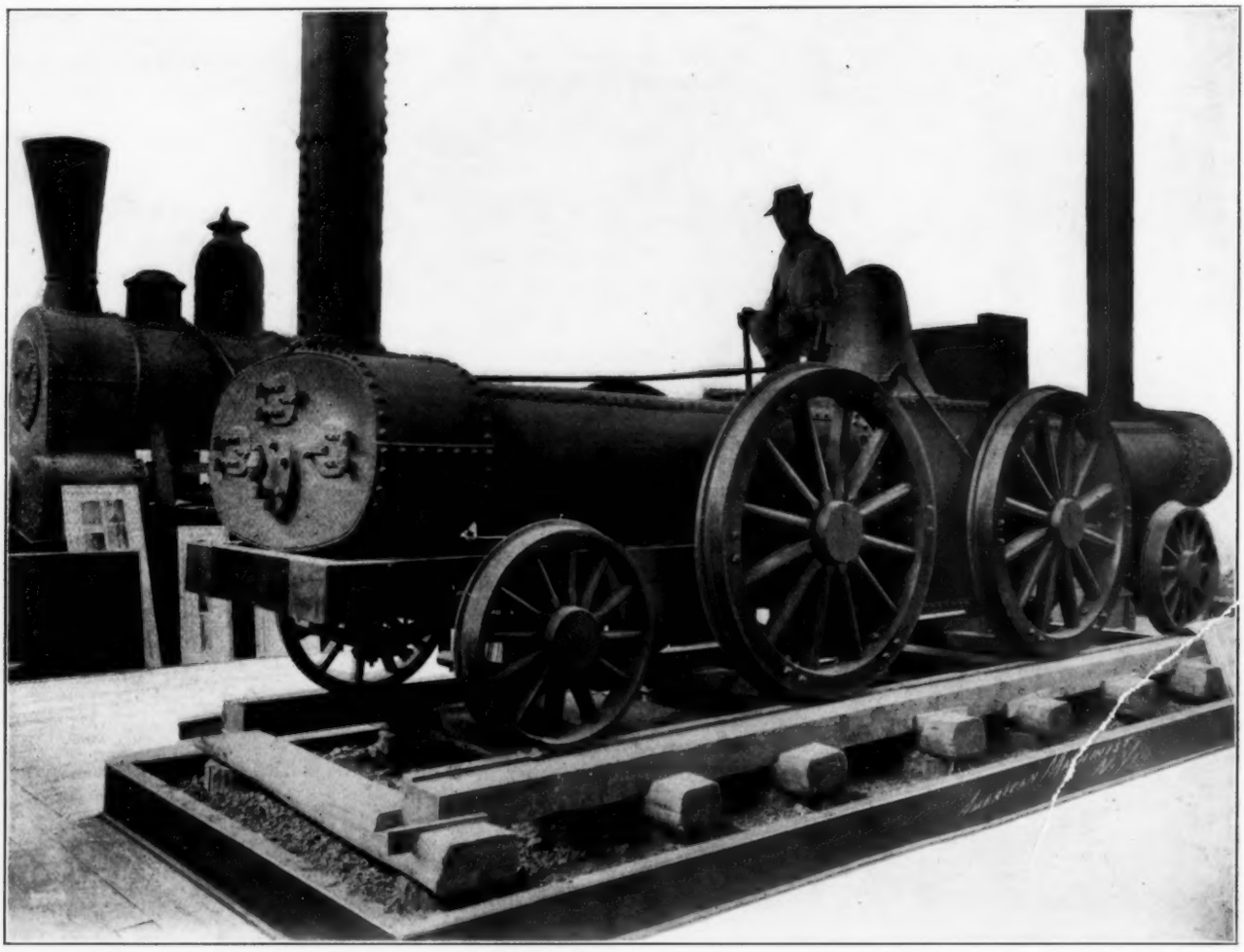


FIG. 20. THE "SOUTH CAROLINA"—1832.

originally built, the arrangement of equalizers was quite different from the one shown, and at the suggestion of Joseph Harrison the form so clearly shown in the illustration was adopted. The "Hercules" was the first to have eight wheels, and in it we see another long step in the evolution of the American locomotive. Here we have the bogie, the outside cylinders, the bar frame, the equalizers and the four connected driving wheels; albeit the frame is composite of wood and iron. With the addition of the cab, the link motion, the saddle and the touch of the refining hand of Josiah Mason, we have the American eight-wheel locomotive of to-day. F. A. H.

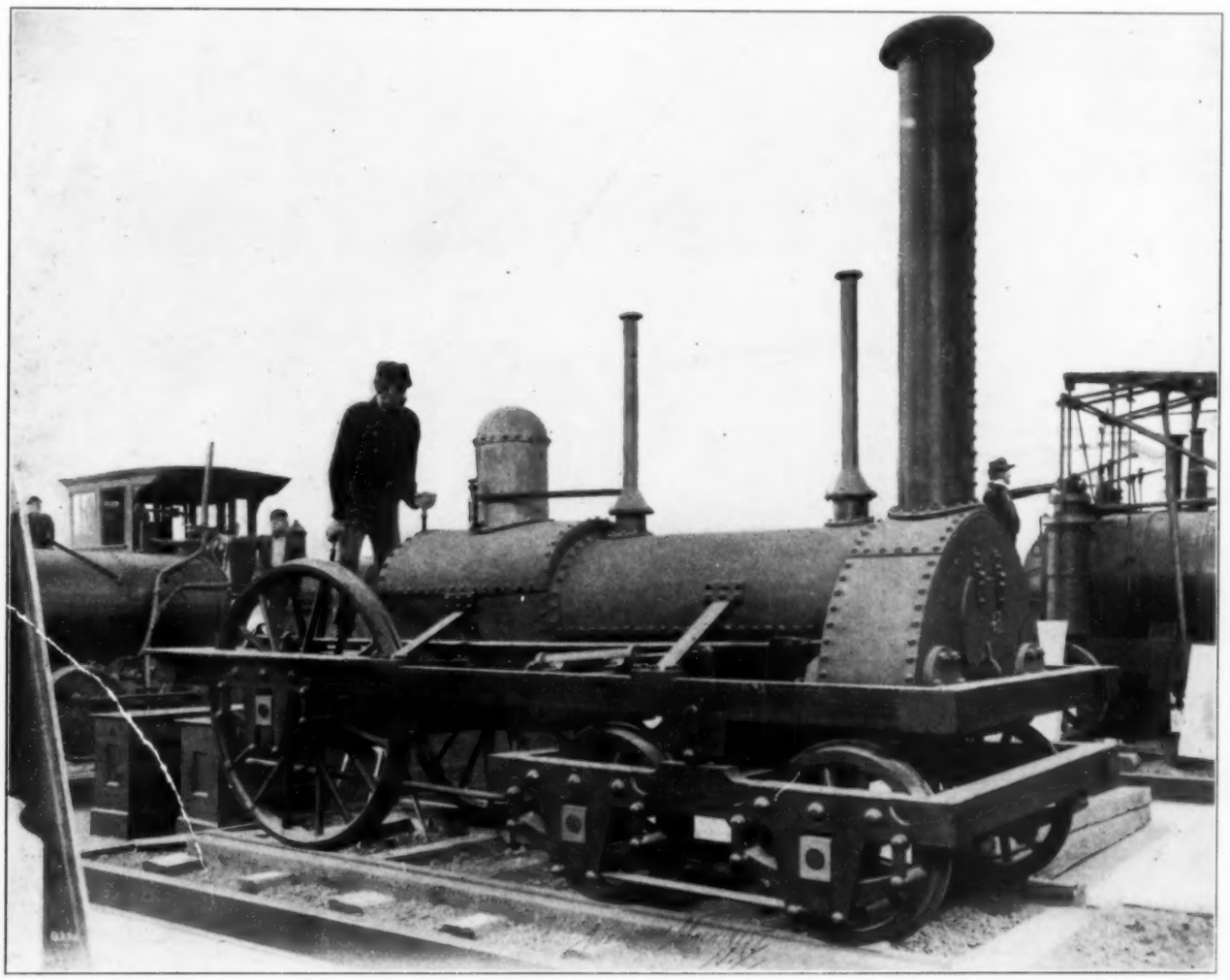


FIG. 21. THE "EXPERIMENT"—1832. THE FIRST TO HAVE A BOGIE TRUCK.

A press despatch of July 25 says: "Rear Admiral Converse, Chief of the Bureau of Ordnance, to-day awarded contracts for about $1,000,000 worth of gun forgings, dividing the award equally between the Bethlehem and Midvale companies. These two companies were the only bidders, and each bid 30 cents per pound. Whether either company will demand that the contract be awarded by lot is not known. In such case the question will be referred to the Secretary of the Navy."

The Machine Shop and the Home.

BY A MACHINIST'S WIFE.

I suppose that every wife is interested in the things that interest her husband, and all the more so if the thing that interests him most is the one that keeps the house going.

I don't know when I first began to read the AMERICAN MACHINIST and other mechanical papers, but there have been times when I have been the eyes for my husband, and he has always done any explaining that I desired, so that I consider myself a pretty fair amateur theoretical machinist.

Of course there are lots of the deep mathematical treatment of the various subjects that I do not pay the least attention to, but when it comes to the letters from practical men I feel that most of them are talking of things that I am pretty well acquainted with; not, of course, in a practical way, as I would not know how to center a piece and get it properly into a lathe and get a cut going on it. I am afraid that I would not know when I was running the right speed, or whether the iron was hard or soft, but I can imagine how the man feels when his job did not come out as he thought it would, and I know just how good the man feels when he makes something work nicely, especially if it hasn't been in the habit of doing so, and I know just how he goes home and tells his wife all about it, and then after supper how they go out for a stroll, and the world seems fair.

It does seem, sometimes, as if the various contributors give views from every possible point that could concern a machine shop in any way except from the home side. I know that a great many machinists have wives and families, and I know that a great many things that happen in a machine shop are influenced by things that seem at first a good ways off from it.

These things may not be worthy of the attention of the great men who have the say as to how the shops shall be managed; what system of paying for the work shall be used; whether divided or multiplied foremen are best suited to the conditions of the work and shop; and other like ponderous matters that come under their attention; but as I understand that all classes of readers deserve to be interested directly some of the time, it has occurred to me that there has not been much in the paper that would interest the wives and

the mothers that have fallen into the habit of reading it as I have. I believe that they will appreciate hearing a little from their side, and I do not think that it will hurt the men very much, not even those that are so unfortunate as to be still single.

I suppose that I nearly always knew that there were machine shops—grimy-looking buildings with dirty windows, and wheels and rough castings, and rusty, good-for-nothing-looking machines lying around on the outside, and an air of gloom inside of the door, to say nothing of the horrid mixture of squeals and shrieks and jars and bumps and groans that told of the desperately hard and dangerous work going on within.

I had seen young men that were minus a finger or two—"the trade mark of the shop," they used to say—and often a man would be around his home for a few days because he was "hurt." I also knew that a machinist got pretty good "pay," especially as "it's not hard work, and lots of them work at it a long time without getting hurt; besides that, it is indoors and is every day, wet or dry." In a farming

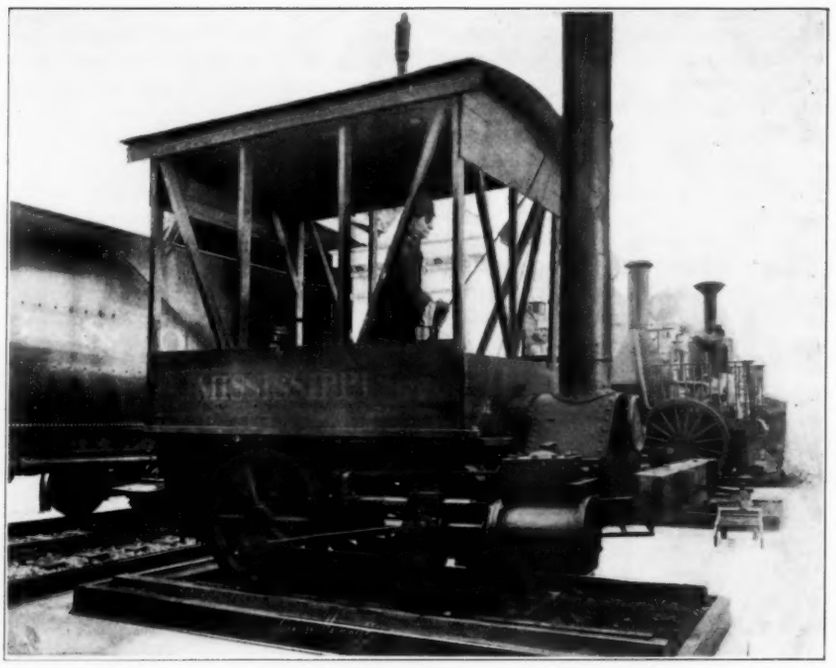


FIG. 22. THE "MISSISSIPPI"—1834.

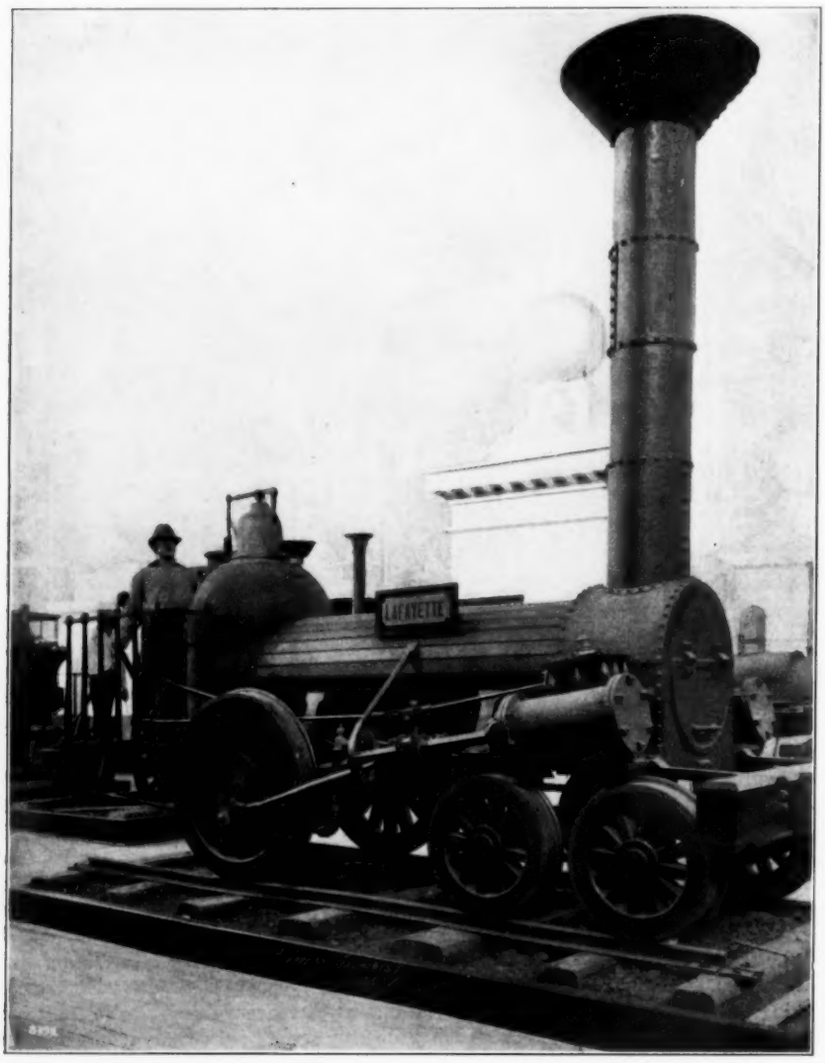


FIG. 23. THE "LAFAYETTE"—1837.

community these things are looked on as important. There would be a certain air of pleasant mystery about the conversation of a certain young man who used to tell me that he was "setting up" engines and "going out." This going out used to be particularly interesting, and I was given to understand that the man that "went out" went whenever he was told to go, without regard to whether it was morning or evening, raining or pleasant, or anything else, except that there was work to do and someone wanted it done then. What he had to do was often uncertain, and when he would get it done and return was more uncertain still.

Accurate information on such subjects is very necessary when a perpetual partnership is being formed, and by the time that locating and getting moved in was a thing of the past, I was very well informed as to the ways of the machinist man—theoretically and in my mind—and in the ways of his shop. After some experience I found that there were a few things that worked out in practise slightly different from what I had looked forward to.

"When I leave home for work in the morning you can never be sure when you will see me again, so you must not be uneasy if I do not show up when I usually do. I am likely to be sent out any time. If you have the meals ready on time, you have done your part, and if I am not here on time I will take what there is when I do come. I can stand a cold meal if you can stand having a warm one go to waste. And you eat when it is time, without regard to whether I am here or not. No use of your waiting, for it might be hours before I would show up." Yes, I had

been told that over and over again, and much more like it.

One evening supper time came, and supper was on the table, but the man did not come to eat the supper. Of course this was to be expected, but somehow the noises of the shop would creep in. If he had gone out on a job why had he not sent word, and if he had not gone out on a job what had happened that he was not home? Common sense and reason are very good things, but under new and strange conditions it is not always easy to make good use of them, especially if one is a trifle scared.

Some time after dark, when I had become very uneasy, there came a step that I had begun to recognize, and the missing husband walked in. His hands and face were unwashed and very dirty. He had his overalls on, and he had a bundle of tools done up in what had once been a grain bag. He had also brought something else that, in the pleasure of knowing that he was safe, I had not noticed, but it made its presence known before we had got very far with our supper. The job was out at the tannery.

Looking up from his plate my husband said, with a look of disgust on his face: "Say, do you smell anything out of the way? It seems to me that I can smell that old tannery and taste it in the food. I never in my life got into a place that had a smell like that before. An oil refinery has a pretty strong smell, but it is attar of roses alongside of that place."

I had been introduced to various strange odors that seemed to follow a machinist home under some conditions, but I was forced to admit that I could plainly recognize that one above them all, and it was most certainly a nauseating one. It was still strong on the overclothes when I was washing them several days afterward. My ideas of a tannery up to that time had been mostly limited to visions of long lines of piles of tan bark that had a pleasant odor. I did not know all the possibilities of a tannery any more than I did those of a machine shop; fortunately I did not have to learn much about a tannery.

A few days after this my husband told me that he would have to do some work after supper. "There is some work to do on top of the boiler up at one of the lumber yards. It can't be done when steam is up, and it must be done so that they can have the boiler for morning. I don't know at all what we may find, so I will take the key to the front door with me."

The night was bitter cold and a strong wind was blowing. Somewhere about 2 o'clock I heard the key in the door, and presently it was pushed open and then pushed shut again and I heard it being locked.

A wood fire is not the best of arrangements for keeping a house evenly warmed, and if it is not a well-built one it will get cold in the night after the fires have died down. This house was not as well built to withstand the cold as it might have been, but it did seem as if it got much colder this night than it had ever done before. The walls and the floors would crack in a way that was startling. From 25 to 30 degrees below zero is frosty weather even with a warm house, but with an ordinary one and the front door standing wide open and facing the wind the temperature inside is not likely to be much above that on the outside. But the door had been carefully locked. It may not be much in the mechanical line, but I learned that when a man has been roasted for several hours and then frozen for a mile or

FIG. 24. THE "HERCULES"—1837. THE FIRST TO HAVE EQUALIZING BARS.

more, and is tired and sleepy, he is not to be trusted with important duties.

One of the important problems of that winter was the one of keeping reasonably warm at a fair cost. I had been used to wood, but wood in the country all cut and piled on spare days in the fall ready for use is one thing and wood in the town at $2 a cord of 8'x4'x16" that has to be split up out in the snow and then carried into the wood house and piled, is another thing. "If the shop would go on short time I think that I could keep a little ahead with what time I have nights," remarked my husband after a windy day had used up more fuel than usual without making things really warm; "but there are things that I would just as soon do in my spare time, at least some of it, as split and carry wood. I'm going to see if we can't use some other kind of fuel." He had been used to coal, but this was not a coal town and coal was expensive.

He seemed to like to figure on something when at leisure, and often we would talk it over as I was doing up the work after supper. If there was anything in the way of mechanical things that he did not know all about, I did not know it. Several people had told me that he was doing the most important work in the shop, and he had a habit of writing things down and comparing them with things that he read out of the books that he had. He had a habit of reading, and the evening that he brought home the AMERICAN MACHINIST not even the necessities of the wood pile could keep him from reading it. Is it any wonder that I thought he must know all about things mechanical?

Near where we lived was the gas works and gas-house coke could be bought at what seemed a right price compared with the price of coal, and we got a load and tried it in our heating stove in the sitting room. It would make a very hot fire and was easy to burn, but took as much watching as the wood did, and then a stove full of coke seemed to make a stove full of ashes. "The greatest good of this kind of fuel is that I have a load each way. I can bring in a bucketful of coke and take out a bucketful of ashes, while with the wood most of it is coming in and very little going out. The coke and ashes are enough dirtier that they are more trouble to handle than the wood. We will see how coal will work." That was the decision of the man of the house, so we got some coal.

I had never been in a coal-using country, but my husband had been raised where coal was the common fuel, and he was used to it—theoretically. He told me all about the beauties of it, and it certainly was much less trouble to keep a fire going with it than with either wood or coke; but, oh! the dirt. Ribbons of soot hanging to the stove lids and to the bottoms of the pots and kettles; a gust of wind sending black, vile smelling smoke out into the room; the hands and clothing getting smutty at every turn; there were some drawbacks even in using soft coal for domestic purposes.

"And there is one other thing," I was told. "The fire can be covered at night and it will keep the house reasonably warm. That is worth a good bit in a country like this."

I felt some doubts on this point, but as my husband said that it had been done right along by his mother at his old home I did not oppose giving it a trial. As I did not have any experience with coal nor had made a study of combustion, I let him manage it.

It took some time to get the fine coal covered nicely over the fire, and to get the drafts arranged so that everything was just to his mind, and it was rather late when we got settled down for the night. That we might receive all the benefits of the warmth the door into the sitting room, where the stove with the banked fire was, was left open.

I awoke with a scream, weighed down with a horror and an awful feeling of oppression. I was smothering and gasping for breath. There was a light burning in the room, but it seemed faint and far away.

My scream awakened my husband, who seemed to grasp the situation at once, for he jumped up and ran and opened the outside door and came back and shoved the window open as far as it could go. My, what an icy tempest swept through the room! Catching up the lamp he went out by that stove. It seemed to be sending out black smoke from every crack and crevice, and there were more in it than I thought were in any stove ever made.

It took quite a lot of coaxing to get the fire to burning as it should, and then we lay and watched and tried to keep warm, while the stove got red hot, and the black smoke seemd to go out very slowly for all of the icy blast that was coming in at the window, across the bed, by that hot stove and out at the open door. About 3 o'clock the air got pure enough so that we thought it safe to close up the window and door, and by that time we had thoroughly made up our minds that when we tried that again the thermometer would not be in the thirties below zero, and a blizzard blowing.

The educated mechanic of the house said he thought it was so cold outside that the air was nearly solid and that the gases therefore could not get out. He has since often said that he thought it was a matter of good luck that there was not an explosion when the fresh air was let into the room, and that if he had known as much about the action of gases as he does now, he is afraid that we would have taken refuge in the woodshed while he thought of some plan of action. Perhaps if he had known that much he would have known better how a mongrel stove that is warranted to burn wood or coal perfectly, would act, and would not have tried the experiment.

I am not sure that any money was saved that winter by burning coal, but the effort to have it burn as it used to do in the distant home of his childhood made a Natural Philosophy and a First Book of Science much more familiar than they otherwise would have been, and we *could* burn it days and evenings.

Some Lathe Attachments for the Amateur's Machine Shop

BY ROBERT G. GRISWOLD.

The article by Everett E. Pomeroy on "The Equipment of an Amateur's Machine Shop," at page 1378, interested me greatly, chiefly because it has been necessary for me to care for a lot of tools in limited quarters, and also in a small room of a private residence.

I believe that I voice the sentiments of other amateurs and inventors in suggesting that, if possible, an exchange of ideas in this field be printed more frequently in these columns for the general assistance of all workers interested. Owing to limitations in room, equipment or funds, the amateur is frequently forced to adopt some expedient for doing work that will be of great value to his co-workers if published.

As it frequently happens, a 9- or 11-inch foot-power lathe and a small hand-drill press constitute the "machine tool" factors of an amateur's outfit, but perhaps there is no one machine which, with a few auxiliary attachments, is capable of handling such a scope of work or performing such a variety of operations as a lathe.

In general, foot-power lathes are capable of handling work up to their capacity, so rigid are their beds and stocks, for which the builders are to be thanked.

It is hoped that the ideas herein pictured and described may be of as great value to someone else as they have been to me, but the object should not be misconstrued. While the operations for which the various attachments are built, would in general practise be performed on machines built especially for that purpose, they place in the hands of the amateur means for performing a number of operations that would otherwise have to be done by hand, left undone, or necessitate the work being taken to some fully equipped shop. This would often incur considerable expense and consume valuable time. With a little care and patience, the work can be turned out quickly and with general satisfaction.

What has proven to be one of the most valuable small attachments for the lathe partakes somewhat of the form of an adjustable knee plate illustrated in Fig. 1. There are many irregular shaped pieces that may be turned, bored, drilled or faced by its aid, and in some instances with as great, if not greater, facility than on a milling machine or shaper. It possesses one advantage in that the work is adjustable in various planes without the use of packing, shims or irregular blocking. Furthermore, holes may be drilled or bored at an angle to a face or to each other with absolute certainty as to their accuracy, in anything that is within the capacity of the

chuck. In facing off the edge of very thin pieces it is necessary to back up the work with a stiff block to prevent the tool lifting it off the face on one-half the turn.

If desired, the fixture may be made in the form of a special chuck which screws on to the spindle direct, or it may be made to fasten to the face-plate by bolts, as shown, the latter method being preferable on account of its adjustability.

The base block *a* is made of a good grade of gray iron, or better still, cast steel. The face *b* can be turned to a flat surface by blocking it up on the face-plate, small lugs having been cast on the piece for this purpose and afterward cut off. The holes for the holding-down bolts are then drilled, the block fastened to a knee on the face-plate and the hole for pin *c* drilled and reamed for a ½-inch pin, which should be of tool steel, hardened and, if possible, ground to size. The inside and outside bearing faces of the lugs *d* should be faced at the same time. The binding screw *e* is a ⅜-inch case-hardened set-screw with a small brass washer on the end to bear against the platen quadrant. The platen *f*, which is also made of cast steel or iron, has the hole for pin *c* bored on a knee, as above. It is then mounted on a mandrel and the bearing faces turned true. It should fit very snugly between the lugs *d d*, so that there may be no play. The quadrant may be finished while the piece is mounted on the same mandrel, working it through a quarter turn by hand, the tool being given a very light feed. When the pieces are assembled as a whole, they are fastened in position on the face-plate, the platen clamped with its face parallel to that of the face-plate, and this face trued. It is then swung through an angle of 90 degrees and the outer edge trued. Several holes are then drilled and tapped for ⅜-inch clamping bolts.

It may be remarked here that in every case the attachments have been designed so as to be readily built by the amateur, and, with a very few exceptions, require no work done outside.

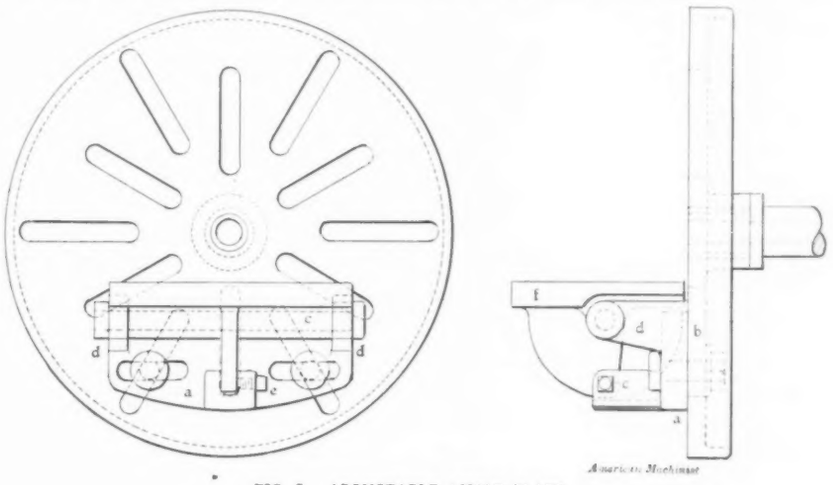


FIG. 1. ADJUSTABLE ANGLE-PLATE.

The attachment illustrated in Fig. 2 transforms the lathe into a horizontal boring mill. The gray-iron platen *a*, the pattern for which is simply made, is secured by two ½-inch fillister head screws to the tool carriage, which, being gibbed to the lathe bed, renders it unnecessary to gib the platen thereto. Thus the carriage furnishes the feed while the cutter bar is driven on the centers by a dog and face-plate. Four-inch cylinders have been bored on a 9-inch lathe in this way, and were perfectly true and parallel. The roughing cuts were not particularly hard to drive, as the feed was very fine.

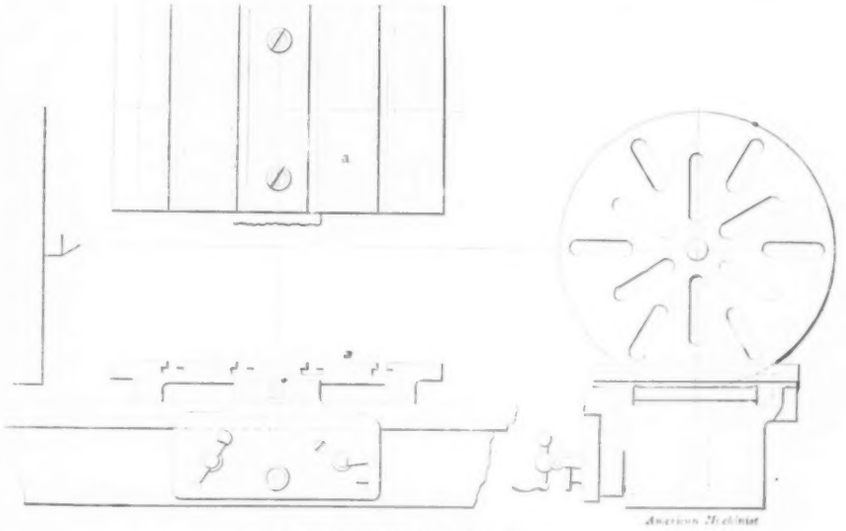


FIG. 2. PLATEN FOR BORING.

After having the surface of the platen planed to a true surface, the T-slots should be planed true and square with the line of centers, which center line may be scribed on the platen after fitting to the carriage. A 6-inch knee is then planed to a right angle and provided with a series of holes for clamping to the platen. A 1¼-inch hole is drilled through the knee on the line of lathe centers, so that a bar may pass through when work is clamped to the knee.

The feet of the platen, which bear on the lathe bed, are scraped to an even bearing. In taking moderately heavy cuts, the overhanging platen ends will sometimes chatter slightly as the tool takes an upward cut. This is easily prevented by suspending a heavy weight beneath the lathe bed from a stick placed across the end of the platen.

While the adjustments in this case must be made by shifting the work the time consumed need not be great and is amply compensated by the enhanced value of the lathe for general work.

Another attachment which may be used in direct connection with this platen bed is shown in Fig. 3, and is used for facing the ends of cylinders or other large work that cannot readily swing on centers. The cutter *a*, which is made of ¼-inch round tool steel, is carried in an arm which is pivoted at one end to the face-plate by pin *b*. The cutter end of this arm is constrained to move in one plane by an arc *c* fastened to the face-plate and having a beveled edge under which the toe of the arm moves. This prevents the thrust of the tool from twisting the arm. The feed is accomplished by the screw *d*, provided with a star-wheel at one end. The points of this star engage with a pin inserted in the lathe bed. All joints should be made very snug fits, especially the feed screw and nut. The cutters being held in place by a set-screw, ready adjustment and change are made possible. The strain on the tool is a direct pull on the arm, which will at all times keep it firmly to its seating, no matter whether the tool is working near the center or outer edge.

In making fine fits for cylindrical pieces there is no method so accurate and quick in its results as that of grinding, and a lathe may be transformed into a temporary grinding machine very easily. If there is no play in the live spindle, or tail either for that matter, and the carriage has not worn the ways to such an extent that it does not move in a straight line, a very fine line of work may be executed

with the inside and outside grinding attachments to be described.

On account of the very high rate of speed necessary for inside grinding, I prefer to use two separate fixtures instead of merely changing wheels. In the first place, for external grinding the wheels are generally much heavier than those used for inside work, and should be carried on a heavier spindle, while the small wheels can be carried on small shafts and driven from 15,000 to 25,000 turns per minute.

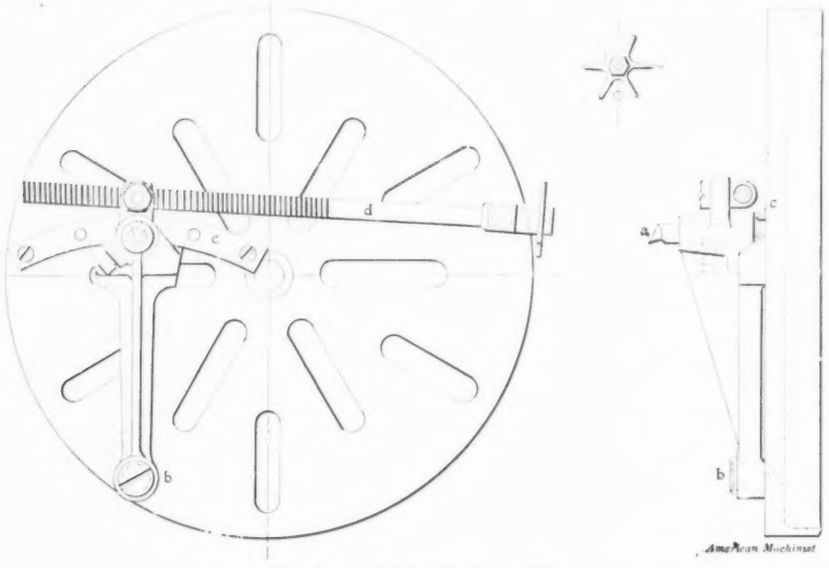


FIG. 3. FACING ATTACHMENT.

In the case of my lathe, the main driving wheel is 28 inches in diameter. From this wheel a light 1-inch flat belt drives a 6-inch overhead drum by a 2-inch pulley. The drum is built of light staves glued together and turned to a true cylindrical surface. While in the lathe a spiral groove of 1-inch pitch was cut on the finished surface to accommodate a fine steel wire which was wound in the groove and firmly secured at the ends. This wire prevented the bursting of the drum when driven at a high speed and the groove being filled with varnish until even with the surface of the drum, has no tendency to make the ⅛-inch twisted rawhide belt follow it. This drum is 2 feet in length, covering the full capacity between centers. The spindle of the inside grinder is driven by a ½-inch pulley and that of the outside grinder by a 1- and 2-inch cone pulley.

In Fig. 4 is illustrated the outside grinder and the mount that is used for both the outside and inside fixtures. The mount or post *a* is made of gray iron. The face *b* is turned true on a mandrel after the hole for bolt *c*, which clamps the fixture in place, has been drilled and reamed. The post is then bolted in place and the hole *d* drilled and finished in the lathe so that its center line coincides with that of the lathe. The under side of the sleeve is then split in two places to form clamps.

The spindle *e* runs in tapered bushings forced into the sleeve *f*. These bushings are hardened, and the spindle also, thus making an excellent bearing of long life. Two brass washers *g* are fitted at the ends to take up any end thrust, but are eased off enough to make a free running fit. They also prevent dust from falling into the bearings when the wheel is in use. The pulley end of the spindle is provided with a loose sleeve bearing which abuts against the ring *h*. This end adjustment, on account of the taper bearings, takes up all wear, and the ring *h* is filed down so as to bring the bearings closer together. The key *k* extends about ⅛ inch into the loose taper sleeve, and the nut *l* sets up the pulley against the sleeve, locking it in place.

This grinder can be set at any angle desired for corner work and the sleeve *f* may be moved in or out slightly to accommodate the wheel to close quarters.

The inside grinder spindle is shown in Fig. 5. The body of the sleeve is made the same diameter as that of the outside grinding fixture, so that they may both be used in the same post; the inside collar of the latter being the same diameter as the sleeve, it can be pulled through the hole *d* when the wheel is removed. While it would not require much time to machine another post, it merely adds another piece to be taken care of, and since these fixtures are seldom in continuous use, the time consumed in changing from one to the other amounts to little.

The spindle *a* is turned from a piece of ½-inch Stubbs' drill rod or, if preferred, ¼-inch stock may be used and the collar *h* welded on. The emery wheels, which generally run from ⅛ to 3-16 inch in thickness in the small diameters, are carried on an ⅛-inch stud at the end, this stud being provided with a thread on which the small nut *b* screws, securing the wheel in place. The collar *c* screws on the 3-16 inch portion of the rod until it jambs, and is then faced off square. The direction of rotation against the resistance of the wheel tends to tighten the nut against the wheel, as it is supposed to work against the front inside surface of a hole.

The bushing *d* is hardened and lapped to size, after being forced into the shell *e*. The loose bushing *f* screws into the opposite end of the shell and is locked in position by the small screw *g* whose point drops into a series of center punch marks driven into the end. The thread is 56 pitch, which allows for very fine adjustment against the collar *h* to prevent end play.

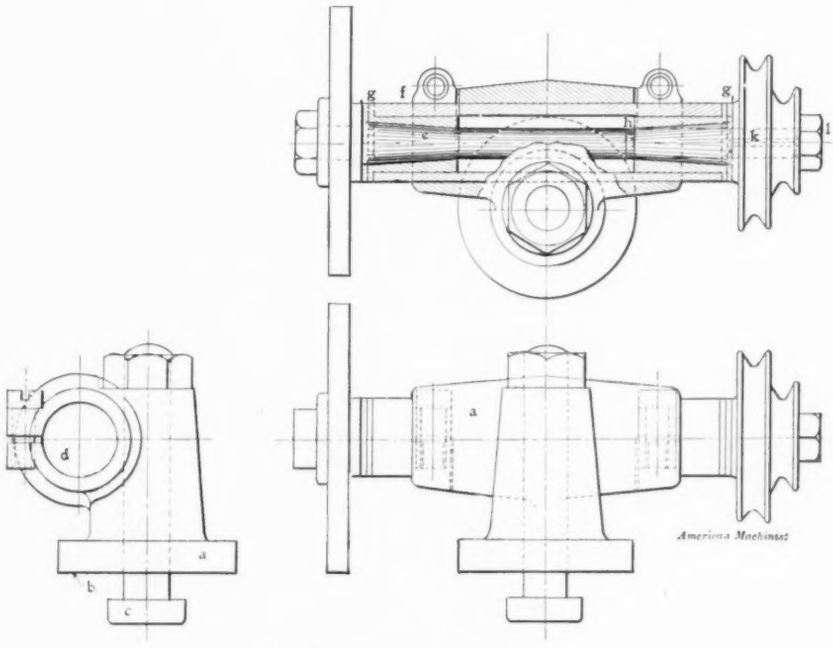


FIG. 4. GRINDING ATTACHMENT.

The only lubrication necessary for eith-

er spindle is to fill the surrounding space with a light oil before closing the bearings. It has been found that sufficient oil will work out into the bearings to keep them perfectly lubricated even at high speeds, and no trouble is experienced from fine emery or carborundum getting into the bearings to cut them. An oil hole is drilled thru the sleeve *f* and shell *e* which permits a replenishment of the supply. This hole is closed by the tube of post *a* when either fixture is clamped in position ready for use.

A Remarkable Gun.

By one of our English contemporaries we learn of an American inventor who has devised what he calls a "ball-bearing cannon." This consists of a cannon which, instead of having the ordinary rifling grooves, has rows of balls inserted in the grooves in such a way that they project about one-third of their diameter into the bore of the gun. The shot is supposed to roll out on these balls and therefore to move very easily. Some very queer claims on behalf of this gun are made. Among others it is stated (in order to forestall a possible criticism that such gun might not be gas-tight) that the shot moves so freely and rapidly that the gases have not time to pass out around the shot. We suppose this means that they would not have time to exert sufficient pressure to go past the shot, and if so, then we would like to know how they would exert sufficient pressure to give the shot the required velocity. It is claimed also that there is almost no recoil because the shot meets with so little resistance in the gun and we are curious to know how this reduction of resistance to the passage of the shot thru the gun can lessen the recoil. We should expect it to increase the recoil rather than decrease it.

Most of our readers are probably familiar with the pictorial post-cards which are sent by travelers to their friends from foreign parts of the world, and which usually depict familiar scenes in the various cities or countries in which they travel. Our friend, H. Bollinckx, of Brussels, Belgium, is the first one, so far as we know, to apply this idea to a machinery building establishment, and we have received from him a set of such postal cards having upon them fine interior views of the various departments of his works.

Letters From Practical Men.

Testing a Lathe

Editor American Machinist:

In reading Mr. Perrigo's very interesting article, at page 720, on "Testing a Lathe," I notice that in leveling up the lathe before beginning the test, he levels from the top of the V's (see page 721); also he ascertains the vertical alinement of the head and tail spindles (page 722) by placing the surface gage on the V's or on a parallel placed on the top of the V's.

If I am correctly informed, the lathe carriage does not, or at least should not, bear upon the top of the V's on the bed, but should bear upon the inclined surfaces; and in leveling the lathe it seems to me the proper place to apply the level will be on the top of the lathe proper, which is the surface upon which the carriage travels. In very rare instances it may be possible for the top of the V's and the inclined or bearing surfaces to agree at all points, but as the sides are usually scraped while the top may be filed or polished or left unfinished, the chances are that the two will not agree everywhere, thus rendering the top of the V's an unsuitable place to level from. And as the turning tool is held in the tool-post, which is mounted on the carriage, and which in turn bears on the sides of the V's, it seems to me the top of the carriage is the proper place to rest the surface gage on.

At page 898 "Art Isan" says: "I consider it poor practise to test the inaccuracy of a screw by comparing it with itself; but if an accurate screw is at hand it is comparatively easy to test the inaccurate one by revolving them both at the same speed, carrying the indicator by the accurate screw, leaving the contact piece to bear against the inaccurate one."

After reading what I have just quoted from "Art Isan," I have tried to make a fairly good guess as to what he might call an accurate lathe screw, and I guessed .010 inch, as I have seen mention made in the mechanical papers of that error. I also read what the late Professor Henry A. Rowland, of Johns Hopkins University, has to say about making and testing screws.

Prof. Rowland also says: "To produce a screw of a foot, or even a yard, in length with errors not exceeding 1-1000 inch is not difficult."

To test the lead of a screw, Professor Rowland says: "Put upon the screw two well-fitting and rather short nuts, which are kept from revolving by arms bearing against a straight-edge parallel to the axis of the screw. Let one nut carry an arm which supports a microscope focussed on a line ruled on the other nut. Screw this combination on the screw, and if the cross hairs bisect the line in every position, there is no error of run." This arrangement seems to act quite like the one shown by Mr. Perrigo, and will enable anyone to test a screw at any time, and will leave out the inaccuracies of a supposed-to-be-accurate screw.

In his letter "Art Isan" speaks about revolving the two screws at the same speed, but I fail to see how he will do it unless he places them in line end to end and drives one by the other—and this method calls for a very long indicator.

I am aware that a pulley could be put on each screw and a belt used to transmit the motion of one to the other, but I doubt if anyone would believe it to be accurate; or a gear could be put on each screw with an intermediate gear, so the two screws would turn in the same direction, and thus the errors in the gears would be introduced.

I am aware that "Art Isan" could finish three gears by hand and finally get his two screws to rotate at the same speed; but does he do it?

Comparing a screw by itself is the same as comparing a surface plate by itself; that is, scraping three plates together.

The same is true of straight-edges, and I may mention that carpenters and patternmakers frequently make themselves straight-edges in the following manner: Two pieces of wood of the required length, and sufficiently wide to insure being rigid, are clamped together in the vise and the required edge planed off as nearly straight as can be done by the plane. They are then removed from the vise and the two planed surfaces placed together. Suppose now the two pieces were planed slightly hollow; they would touch at each end, and at the center would show double the error, requiring the ends to be planed off and tested again until they showed a good fit. Machinists can also make straight-edges in the same manner up to a certain limit of accuracy.

G. SCHNEIDER.

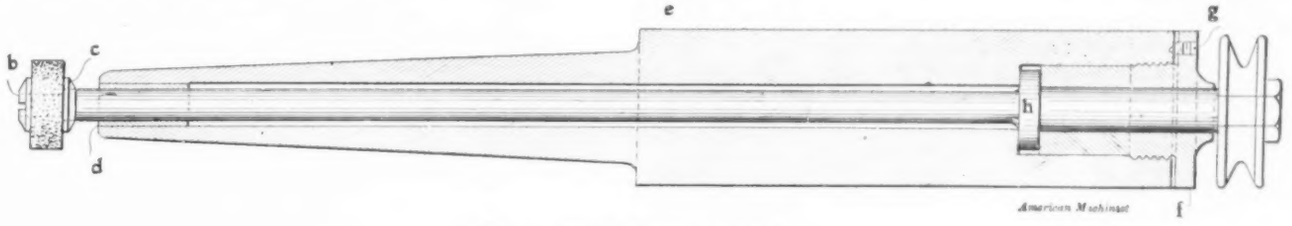


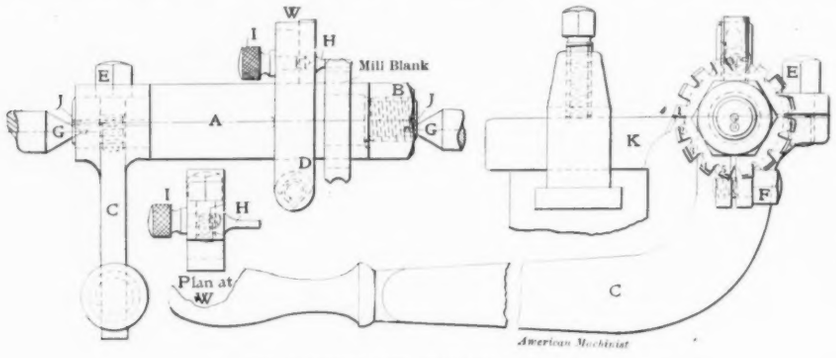
FIG. 5. INSIDE GRINDING FIXTURE.

For Backing-Off Milling Cutters

Editor American Machinist:

The drawings show a fixture for backing off milling cutters. It can do the same work that the large and more expensive machines can do, and do it as well. The fixture is used on any lathe centers. There are two centers in each end of the arbor *A*. Center *J* is the actual center used to turn and cut the teeth, while center *G* is used when backing off the teeth. The cutter blank is placed on the arbor and is fastened by nut *B*. Lever *C* and the adjusting collar *D* are removed from the arbor and the cutter is first turned in a lathe and notched in a milling machine. When the teeth are cut the lathe is taken off the arbor and the adjusting collar *D* is placed in position so that the guide-pin *H* will enter a tooth space in the blank, as shown. Then lever *C* is placed on the arbor and fastened by screw *E*. The fixture is then placed in a lathe on centers *J J*. Lever *C* is adjusted so as to use the lower edge of it for a stop on the lathe bed or the carriage, whichever is the most convenient. It will be noticed that the teeth numbered 1, 2, 3, 4 and 5 have been backed off. To get the next tooth in position to be backed off, first loosen nut *B*, then loosen also thumb-screw *I*, slide guide-pin *H* up out of the way and turn the cutter to the next tooth; slide *H* down again in the next space and fasten by thumb-screw *I*; nut *B* also is fastened. *K* shows the forming tool in the lathe tool-post. The thread cutting stop on the lathe is used to get all the teeth backed off the same hight. The forming tool is fed in while the lever *C* is worked up and down.

GEO. J. LAVIGNE.



FOR BACKING OFF MILLING CUTTERS.

Special Tools for Making Threading Dies

Editor American Machinist:

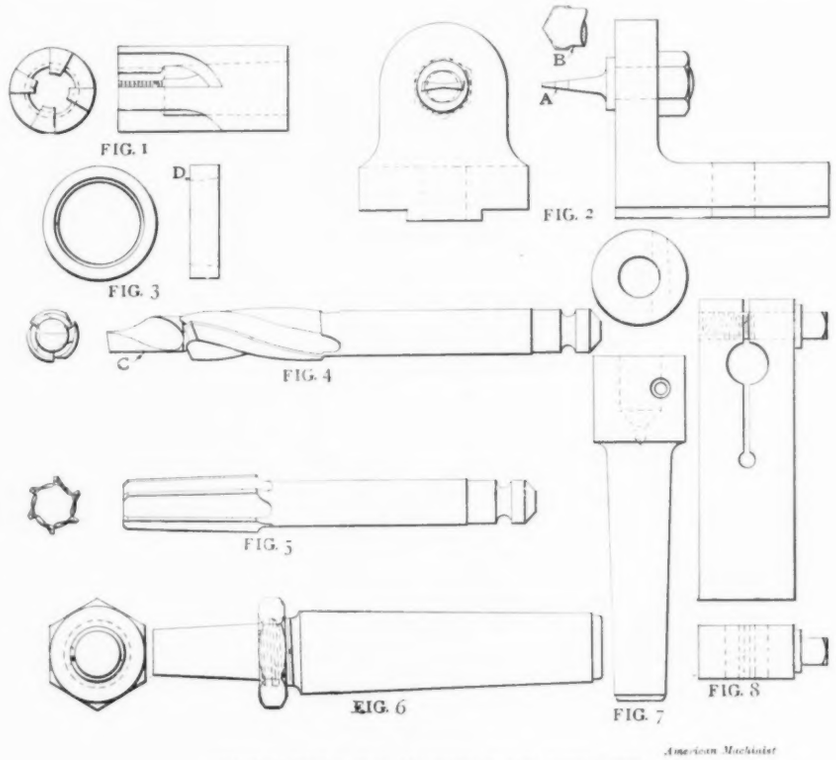
A shop in the Middle West was engaged in the manufacture of a product which required the use of a large number of threading dies and I was called upon to devise a system for making them with the equipment of an up-to-date toolroom. One size of the dies is shown in Fig. 1. The dies were made from what the steel manufacturer calls middling hard Styrian tool steel, and they cut a very smooth, accurate thread on drop-forged Bessemer steel.

The bars, of commercial length, were cut up into lengths that would turn without using the steady-rest and then turned to a standard diameter, after which they were cut up into blanks two inches long in a cutting-off machine. A 14-inch lathe was fitted up with a two-jaw chuck having slip jaws for different diameters of blanks, also with a special tool-post, Fig. 2, and center, Fig. 7. The tool-post holds a centering tool *A* similar to that ordinarily used, with the added feature of cutting on the side at *B*, the reason for which will be explained later.

A blank was put in the chuck and the centering tool was brought into action preparatory to starting the drill for the long hole. After the hole had been drilled the centering tool was again brought up to the work and used as a boring tool for a depth of ⅛ to 3-16 inch, boring to exactly the diameter of the part *c* of the tool shown in Fig. 4, which is a combination of a gun drill and a three-lipped drill. The stop furnished for thread cutting with the lathe was placed in position back of the saddle, as for internal threading, and the side of the centering tool opposite the operator was used to bore the hole in order that the saddle might be brought forward out of the way of the drills and reamer without removing the tool-post and returned to the stop for boring the next blank, thus avoiding the use of calipers after the first blank. If this boring operation is carefully done, the combination drill will run dead true, even tho the first or stock drill ran out; and it will continue true all the way thru the blank. The gun drill part of the tool removes about .022 inch on a side and the whole tool works with surprising rapidity and is very free cutting.

The large part of the hole left by the combination drill was reamed with a taper reamer, Fig. 5, whose cutting edges were serrated (not thus shown) alternately and driven by a driver, Fig. 8, one of which is used to drive the combination drill, the ends of the shanks of both drill and reamer being turned to fit the special center, Fig. 7, which has a taper pin with a nurled handle that fits the taper hole and passes thru the groove on the shank and locks the tools in position, so that they cannot "dig in" and break. The reaming operation is done to enable the dies to be milled on the arbor, Fig. 6, which fits the dividing head spindle of the milling machine. The milling cutter cuts into this arbor, but as the cutter enters the same place each cut no harm is done and the dies are well supported. The use of the backing-off nut needs no explanation.

Before removing the dies from the lathe, two or three master taps were run thru



SPECIAL TOOLS FOR MAKING THREADING DIES.

by power, after which they were fluted and then hobbed with a tap tapering .005 inch per inch. During this operation by hand the prongs of the dies are sprung in by the collar, Fig. 3, so that after tempering they will be in tension when cutting the correct diameter. The reason for this is that trouble was experienced in holding the correct diameter unless the prongs were thus sprung in when in use, and if the dies are hobbed with a tap larger than the diameter which it is desired to cut, the dies drag in the center of the "land" and do poor work. The collar was slipped on part way and a cut was taken with the hob; then the collar driven on till the face *D* was flush with the end of the die and a finish cut taken, bringing the dies uniform in diameter when the hob was run in to the same depth each time on the finish. On the large size dies the combination drill had four flutes instead of three. This tool stands up to its work well, and with this outfit two men did the work that formerly required from four to five.

E. E. MINARD.

Is the "Practical" Man in Danger?

Editor American Machinist:

I read with great pleasure the article under this heading at page 809. I have been somewhat of a wanderer in my time, and have been in close contact, in many lands, with the "practical" man who could

THE STAR-WHEEL DESIGNED BY MR. ROBB.

do things, and also with the technical graduate who could not.

Mr. Ridderhof writes: "Will technical graduates, stuffed brimful with engineering knowledge, gradually crowd out these men, and they be relegated to the rear?"

No, Mr. Ridderhof, they won't; because they are too often stuffed brimful of conceit and useless information instead of knowledge.

A case in point. I was building a certain machine for a firm in Philadelphia. It suddenly struck this concern one day that they ought to have a mechanical engineer of their very own. So they secured the (shall I call it) services of a man about 30, a graduate of one of the best-known engineering colleges in the country. Mr. Lewis Robb was started at a salary of $1,800 per year. I had ample opportunity to judge of his appalling ignorance, as I was in daily touch with him for nearly a year.

I could write for weeks of the things Mr. Robb did not know, but satisfy myself with a few instances, which I trust will allay Mr. Ridderhof's fears for the "practical" man.

One day about two months after Mr. Robb's installation, he addressed me in a sort of grieved voice: "Mr. Dixie, I see there's a cam missing from one of those *supposedly* finished machines which are waiting shipment."

"Yes, Mr. Robb," I replied, "I guess you're right," and went on with my work; for I knew there were no cams on the machines at all.

"Mr. Dixie, I want this corrected at once. Such slouchy work won't pass *me*." He was about 5 feet 2 and slender, and I nearly 6 feet; so in fear and trembling (such was the influence of mind over matter) I followed him, to find that the *cam* that was missing was a *pawl* that wasn't missing but right on the machine where it ought to be.

One day he came to me with: "Mr. Dixie, what is the smallest size *cap screw* you use in those machines?"

"Quarter-inch," I replied.

"Oh, no, they can't be as big as that; I mean the *little cap screws* that you fasten the knife on with."

"Those are flat-head machine screws; they are eight thirty-two."

"Let me see," said Robb; "eight thirty-two; why, four times 8 is 32; so you are right after all—that is quarter-inch. They did not look that big to me." I suppose he thought I meant eight thirty-twoths.

While he was in the shop one day I thought I would test his ability as a lightning calculator. I had an order for a stamp, which was to fall 5 inches and strike a 300-pound blow.

When I asked Robb to work it out for me (I had previously ascertained the size, and the pattern for the weight was in the foundry), he cocked his head on one side and murmured to himself in a stage whisper, so that I might hear and marvel greatly: "*S* equals *V T*. The angle of incidence is equal to the angle of reflection. *Honi soit qui mal y pense.*" And then with pencil and reams of paper he obtained this startling result: 3.1250018 pounds of iron at a temperature of 62 degrees Fahr., with the barometer at 30 inches, falling 5 inches, would strike a 300-pound blow.

One more example of Robb's ability as an unmechanical engineer. He was designing a machine on which he put a cam 12 inches in diameter. This cam was to produce a vertical movement of 2 inches on a plunger. During one-sixth of the revolution of this cam, a shaft at right angles to the cam shaft was required to rotate one half turn.

Robb asked me in a kind of sneering, patronizing way how I would give the motion to this second shaft.

"Try intermittent gears," said I. "Oh, I don't like intermittent gears; they are too noisy." Next day he called me over to his drawing board and showed me a *silent* (?) mechanism.

On the rim of the cam he had three ¼-inch pins. In the ¾-inch shaft, at right angles to the cam shaft, he had drilled in the same plane, at right angles to the shaft, six ¼-inch holes, 60 degrees apart. Into the holes in the shaft he proposed to drive pins and use it as a star-wheel. The minimum speed of the perifery of the cam was to be 180 feet per minute. The way the star-wheel (or would pin-wheel be more appropriate?) was made, it would move one half revolution while the rim of the cam traveled about 1¾ inches; so that the star-wheel would do its little stunt in about the 1-1200 part of a minute. If this device were not silent at first, it would be likely to be so after it had received a bat or two from the pins on the cam-wheel.

The illustration shows the amount of metal left to support the pins.

At page 832 is shown how the job was eventually done by the "practical" man. The little hole in the side of the large gear in position on the model is where the crank-pin was screwed in, to give the vertical movement to the plunger, and this pin and spiral gear, weighing about 2 pounds, took the place of Robb's cam, weighing 16 pounds.

DIXIE.

Two Kinds of V-Blocks.

Editor American Machinist:

V-blocks such as shown in Fig. 1 may be seen in almost any old shop. As a gen-

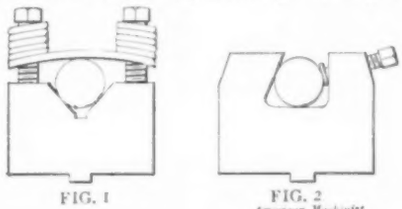


FIG. 1 FIG. 2

TWO KINDS OF V-BLOCKS.

eral thing, they will have a couple of ⅞- or 1-inch screws with the large head standing up and an old bent clamp on them.

The holes have been retapped often, because the threads were pulled out by using screws that were too short. It is somewhat annoying to have to hunt up screws the right length when you are in a hurry to do a job. The result is, most fellows won't hunt and will either take chances on a few threads holding, or stick a bunch of washers on the screws.

Fig. 2 shows a block that is neater, much more handy, and has but one screw to tighten up. The gap in this block can be made any size. Any great movement of the set-screw can be avoided by placing a piece of packing between the work and screw. Many jobs can be swung over the top of this block on account of the clamp and screws being out of the way; it also permits of passing a tool thru to keyway a shaft or similar work.

H. L. CAMERON.

Compound Curved Patternmaking.

Editor American Machinist:

In a large jobbing shop where I was working, an order was received to make several patterns from which to cast forms for shaping the copper sheets used in making cowls. These cowls are seen on steamships and elsewhere, forming the tops of the ventilator or air circulating pipes and are like elbows of constantly varying diameter. The size of the cowls ranged from 18 inches to 108 inches on the big ends.

First the foreman figured the amount of stock and time, and then a man was given the smallest one to make, with the expectation that we would learn just how to build the larger ones by seeing this one built. The man got out a good, straight board and laid down the profile of the job or its shape at the center line and allowing a great deal of stock he built up one-half out of segments and after straightening up the ends and laying out the semi-circular lines on them determined that there was stock enough to work out. He then built up the other half, and while the glue was hardening he started to work out his first half. The ends were laid out simply a half circle and also the lines on the joint from one end to the other, but how to get these latter lines inside was the problem. He divided his joint lines into equal spaces and then took a "spoon gouge" and worked around, using a two-foot square to find the high places. As the job had a big flare the square was apt to tilt and it was impossible to get a perfect line, but eventually the piece was worked out; and what knowledge that we could use on the next one? None.

The next size was built on the same principle, only instead of the steel square a large wooden square was made and used; then the larger ones were started. First the lay-out was made on a true board and forms of the several semicircles at the spaced lines were built and fastened down and the segments were built around these forms, the assumption being that the edges of the forms would give us the lines which they did, but the process was a slow one.

I was given the four-foot one to make. I laid out the outline on my board and after I had the sizes started to think what use I could make of what I had seen in the building of the others. I could not use a square, and building it up on forms seemed too much like work. First I built up the two pieces. Then I took my lay-out and with radiating lines divided it into ten parts, got the center on each line, and then knew the diameter at ten different places. I put down tin tobacco tags and punched correct centers in them; then took my trams and on the bar put a line and number, so it was easy to get the different diameters quickly, and every time I put up a row of segments I squared up from the lay-out, drew a line across on both rows, then with the trams I could get the different points, drive a nail in each and with a batten or strip get a line. When I had a row I would saw out a duplicate row, number it also and put it under the bench for the other half.

Building up was fairly easy; now came the problem to work it out. I was sure I had it to within an eighth of an inch, but to get a true line cut a 2-inch piece about 10 inches wide and straightened it, screwed a smaller piece to it in the center and squared it, see Fig. 1. Now I had a good bearing for the arm, and for this I used cherry. On the end in a groove I fastened a Daniels planer bit which I ground with a round nose. My theory was that the bar, being placed with its center in the correct position, the arm swinging around would give me a true line, which it did and very quickly, too. Fig. 7 shows all the lines worked in. It was an easy matter to get the different diameters by changing the length of the arm.

Next the job had to be smoothed out. I got a "Singed Cat" all steel hatchet, and by concaving the blade and having it hardened I had a good roughing-out tool, and then by working from one line to the other with a big spoke shave it was an easy mat-

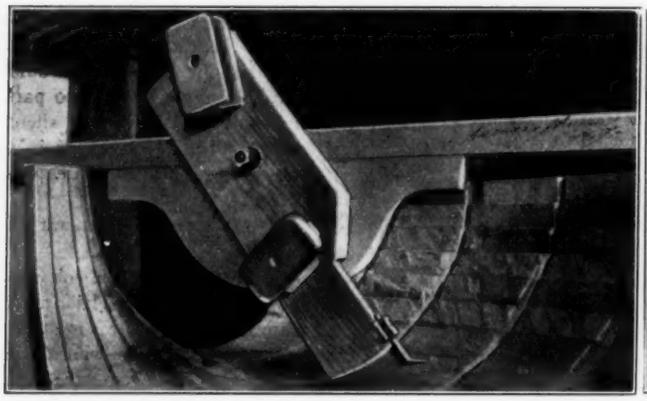


FIG. 1. CUTTING THE SEMI-CIRCULAR OUTLINES.

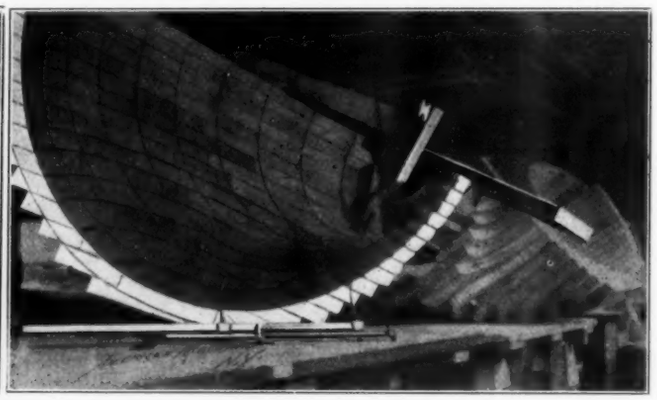


FIG. 2. THE LINES WORKED IN.

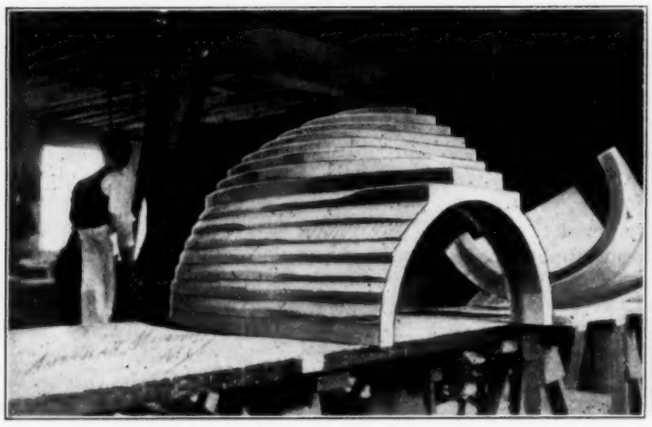


FIG. 3. READY TO DRESS THE OUTSIDE.

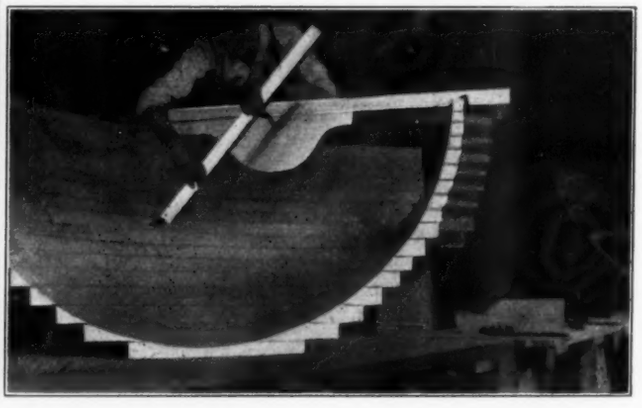


FIG. 4. DRAWING LINES FOR PARTING THE PATTERN.

ter to make a good, smooth face and true. The thickness was got by boring quarter-inch holes and driving in pins that were the right length and then working off the stock outside until the pins were reached. Fig. 3 shows one-half worked out, and ready to be worked down to the pins. Fig. 4 shows the method used to draw lines so as to lay out the lines running lengthwise, as the pattern is put together and then cut into four parts. One cut is shown in Fig. 5. It also gives you an idea what the job was like. The difference in the time was: the four-foot one took twelve days, the five-foot (which I also made) took ten days, and the six-foot one, which was built

FIG. 5. A PIECE OF THE PATTERN AFTER SAWING APART.

on forms, took twenty-one days. The other cuts show the nine-foot cowl form which was 1½ inches thick. J. F. BEHNY.

Machining Bronze Half Bearings.

Editor American Machinist:

Referring to the method suggested by "Toolmaker" at page 894, for milling the bore and contacts on bronze half-bearings, any jig or fixture for holding these bearings while being operated, must necessarily clamp at each end of the bearings. Then when the broad cutting surface of the milling cutter is taken into consideration operated at a speed and feed rapid enough to equal the work performed by the shaper and boring machine, the heat which would be generated by the cutter would be so great as to cause the bearings (which are usually made light of weight, thereby effecting a saving in metal, and therefore not capable of carrying away this heat) to expand and become very tightly clamped in the jig, with the result that when they are removed the contacts and bore are very badly sprung out of true. The line reaming would partially help the bore, but what about the contacts? Assume a boring machine running at a rather slow speed for this work, or 100 revolutions per minute, 1-32 inch feed; the hole being bored in the bearing 5 inches in diameter by 7 inches long. This will be found to consume 2¼ minutes' time; increase the feed double for the finishing cut, the bearing is then complete in 3⅜ minutes for both cuts. Add to this the short time previously required to plane the contacts, then we have rapid work at a slow speed. Use high-speed steel, throw the belt up a notch or two, and this time can be cut in two.

C. S.

Filing the American Machinist.

Editor American Machinist:

The result of my efforts to file the back numbers of the AMERICAN MACHINIST so that they would be most accessible for reference may be of interest. I have saved the papers for several years and had not been doing so very long before I felt the want of some better means of keeping them than in a pile on the closet shelf. I found that the discomfort of using them when so kept has often prevented me from referring to them when I could no doubt have done so to good advantage.

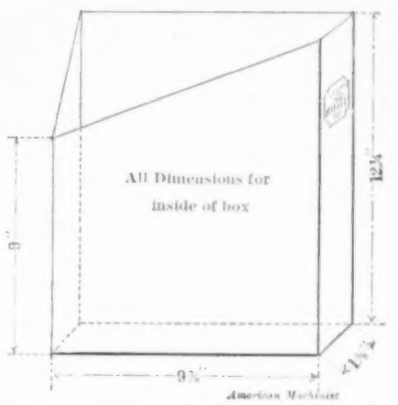
I have tried binding them in volumes of six months each, but the volumes are even then so large as to be hard to read or refer to, particularly when one has to handle over and refer to the indexes of several volumes. Then, again, the trouble of sending them periodically to the binder, and the necessity of being without them for some considerable time while they are being bound, is objectionable.

I once tried one of the binders on the market. The change in the character of the fastenings used by the printer of the AMERICAN MACHINIST prevents, however, the use of that binder, and at the best it took some time to place the numbers, or to remove one in case it was desired to take it to the office.

Another scheme tried for some time with fairly satisfactory results was the use of ordinary letter files of a size that fitted closely. The thickness, however, prevented the keeping of them in separate units of, say, six months or a year, in each file without a good deal of waste room, and it was found also that the effort required to remove and open the file was something of an objection. Such a scheme I notice is referred to by Mr. F. W. Caldwell, at page 65, Vol. 26.

Recently I went a step farther with what I believe will give very satisfactory results. I would first state that I have always removed the advertising matter to reduce the bulk. Open top boxes, like the sketch, were ordered from a local box factory at a cost of 25 cents each. They are made of heavy pasteboard, covered with black cloth with the corners reinforced with an additional layer of the same material, and are of such a thickness as to hold comfortably four months of the AMERICAN MACHINIST, or one year of *Power*, the back numbers of which I preserve also. A box of such size is easy to handle, and with one side and the back edge cut down as shown, the leaves can be lifted up page by page until the desired page number is found, the number containing it being then removed without disturbing the rest of the numbers in the box. One advantage I find is that the permanent place is provided at once for the papers as they arrive, it being as easy to file them in the boxes as anywhere, so that the file is always up to date. Also the boxes can be used over again in case one does not care to keep the numbers after a certain number of years (provided the printer does not in the meantime make too great changes in the form of the paper).

The index sheets are bound in a thick paper folder by means of brass clips, using a conductor's punch, one that punches an oblong hole, for perforating the sheets. My punch cost 25 cents. A folder containing several years of index sheets is



BOX FOR FILING THE "AMERICAN MACHINIST."

light and easy to handle, and can be used with ease. I either lay it flat on a convenient table, noting the year and page number of such articles as I may wish to refer to, or it can be easily held in the hands for the same purpose. I have found it convenient to write the year at the top of each page of the index so as not to have to turn back to the first page for that information.

A sticker is placed on each box labeled as follows:

Am Mach.
1902
Vol. 25
May—Aug.
609 1248
(2)

The number at the bottom indicates whether it is the first, second or third section of the year, and the figures above on each side indicate the page numbers included in the box. The number at the bottom enables one to replace the box on

the shelf easily, the year and page number being noted only in referring to them. I find the arrangement very satisfactory, much more so than any of the other methods I have tried. The back numbers of some other publications which I have in my possession are treated in the same manner with boxes of proper size and with equally satisfactory results. The boxes make a neat appearance on the shelf of a bookcase, and with nicely lettered labels would not be out of place in the most conspicuous position.

W. M. WICKHAM.

Saving Time on Scroll Patterns

Editor American Machinist:

No feature of patternmaking is more fascinating, perhaps, than scroll work, and yet this may prove wearisome and unprofitable unless the workman succeeds in getting it off his hands within a reasonable time. There is many a job of this sort at which a man cannot make his salt unless ingenious enough to devise short cuts. When a job of this kind comes to hand, the first question to ask is, which is the quickest way to make it?

Certain kinds of scroll work are necessarily difficult, as in cases where the spaces are small and the ornamentation quite complicated. In such jobs the work must needs be done by brace and bit and chisel. In fact, they must be carved out by hand, a somewhat tedious and time-killing task. In many instances, however, the saw, either jig or band, can be profitably employed. The preference is always to be given the latter when it can be used. The band saw does smoother and cleaner work, and does away almost entirely with the necessity of trimming. A well-filed band saw will cut so clean that nothing remains to be done really but a little sand-papering.

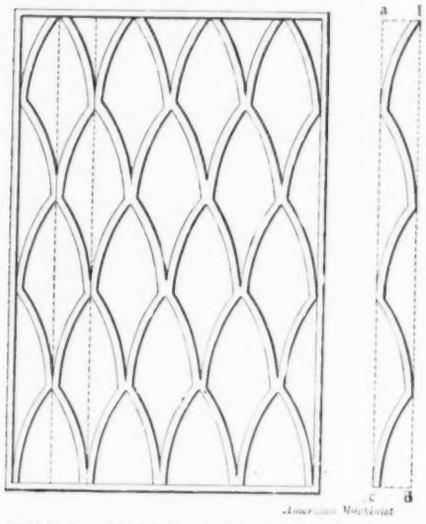


FIG. 1. DIVIDING A PATTERN FOR BAND SAWING.

In Fig. 1 we have the pattern of a scroll-work panel, ⅜ inch thick, for a bronze door. One would at first be inclined to think the best way to make the panel would be to take one full-sized piece of wood and cut the scroll by means of a jig saw. The result, however, would be most unsatisfactory. The edges of the bars would be rough and ragged, requiring a great deal of trimming up to make the pattern at all presentable. Better make the panel out of eight strips like *a b c d*, all

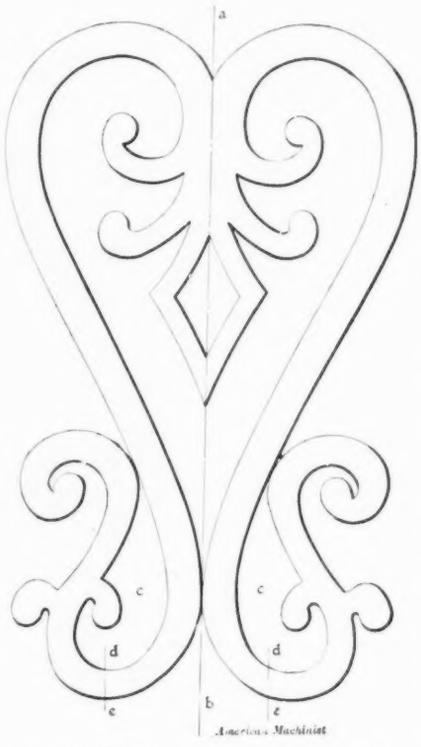


FIG. 2. ALL DONE WITH THE BAND SAW.

of the same length, width and thickness. Let these be tacked together one on top of the other and then marking out a single bar on the uppermost one; all can be cut at once with a single going over by the band saw. You will have a clean, smooth cut, needing no other finishing than a touch of sand-paper. Taking the strips apart, the bars can then be glued together, making at once a neat piece of work and accomplished with no waste of time. As for the frame around the panel, that can be adjusted after all the bars are glued together.

Or take the ornamental piece shown in Fig. 2. This also could be jigged out of a single piece, planed beforehand to the right thickness. But we would experience the same trouble here as in the other case. Rough and ragged edges would necessitate the use of a chisel to smooth them off. By taking two pieces, each wide enough to make one-half of this ornament, tacking them together and pasting one-half the drawing on top, the band saw can be used here again with good effect in cutting out the spaces. After a little sand-papering, the two halves can be glued together, giving us the entire scroll ornament with very little fuss or trouble. The glue joint is shown at *a b*. Even the space *c* can be cut by the band saw by simply sawing through the bars at *d c* and then following the inside lines. The slot thus made in the bars can be afterward filled with a thin sliver of wood firmly glued in its place.

In most instances of scroll pattern work, the band saw will be found feasible in giving better results and saving much time.

HOMO.

Casting Bronze Upon Iron.

Editor American Machinist:

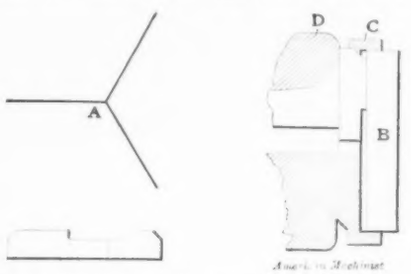
I would like to inquire whether any of your experienced readers and correspondents can tell me of a successful way of using bronze or other hard composition poured into cast-iron boxes the same as babbitt.

B. H. B.

A Locating Spider for Spring Chuck Work.

Editor American Machinist:

A lot of small disks had been made, and it was afterward found necessary to reduce them in thickness a few thousandths previous to milling. The value of the job was not sufficient to warrant chucking on an arbor, and as the blanks were small (¾ inch diameter) they could be easily handled in a split chuck in a clock lathe. It was found, however, that they had a tendency to cant in the chuck and also that a slight difference in tension on the draw-in spindle or in the size of the blank made a considerable difference in the position of the blank with regard to the slide-rest tool, this making it impossible to remove the right amount of stock by setting the slide-rest. This difficulty was overcome by means of a spider shaped as shown at *A* and made as follows: A blank *B* was gripped in the chuck ready for turning and a piece of sheet tool steel was selected that was free in the slots of the chuck when the latter was closed tightly upon the blank. The spider was made from two pieces of this steel soldered together at *A*. As there was scarcely any strain on this point, ordinary tinsmiths' solder was strong enough. This spider was then ground on the bottom so that it was perfectly level and placed in the cuts of the chuck *C* with the ground side toward the end of the spindle *D*. On tightening the chuck this spider was drawn against the end of the spindle and held firmly, and in this position a light chip was taken over



A LOCATING SPIDER FOR SPRING CHUCK WORK.

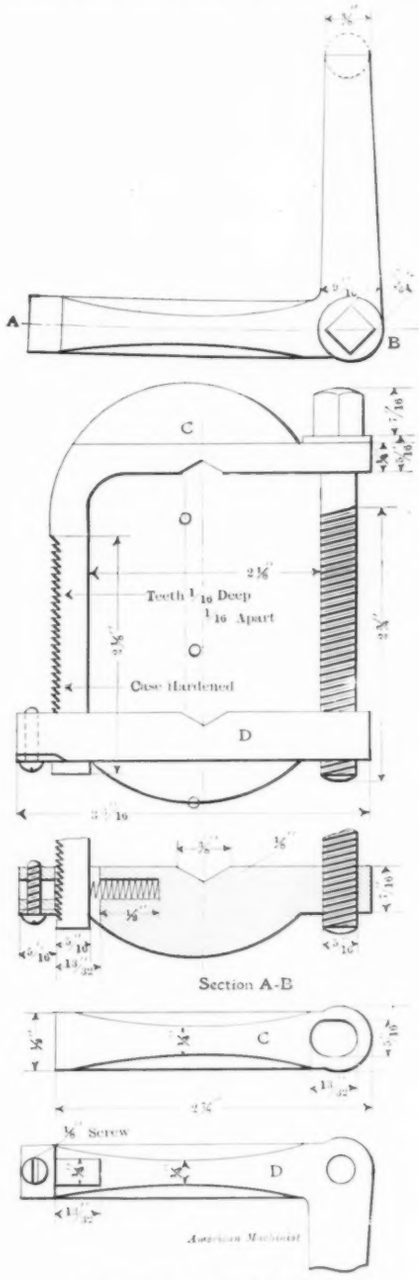
its projecting edges. A blank was then placed in the spring chuck with the spider in position as shown and on tightening the draw-in spindle the blank was drawn firmly against the face of the spider which, resting against the end of the spindle, in-

sured the blank being held truly and always in the same relative position to the slide-rest. A. R. R.

A Quick-Acting Clamp Dog.

Editor American Machinist:

I send you a drawing of a novel lathe dog which I made some two years ago. I have found it a very useful tool for rapid work. The main part of the dog is held, where it is adjusted, by the spring in the lower part *D*. This is a great convenience where there are a large number of pieces



A QUICK-ACTING CLAMP DOG.

of the same size to be operated upon. As the teeth are 1-16 inch apart, the adjustment for size can be made to within 1-32 inch. The adjustment of the dog is made by disengaging the ratchet teeth from the tool steel dog, provision being made for this in the slot in piece *D*. The hole in *C* under the head of the screw is elongated also. As a whole, I have found this superior to the old-style clamp dog.

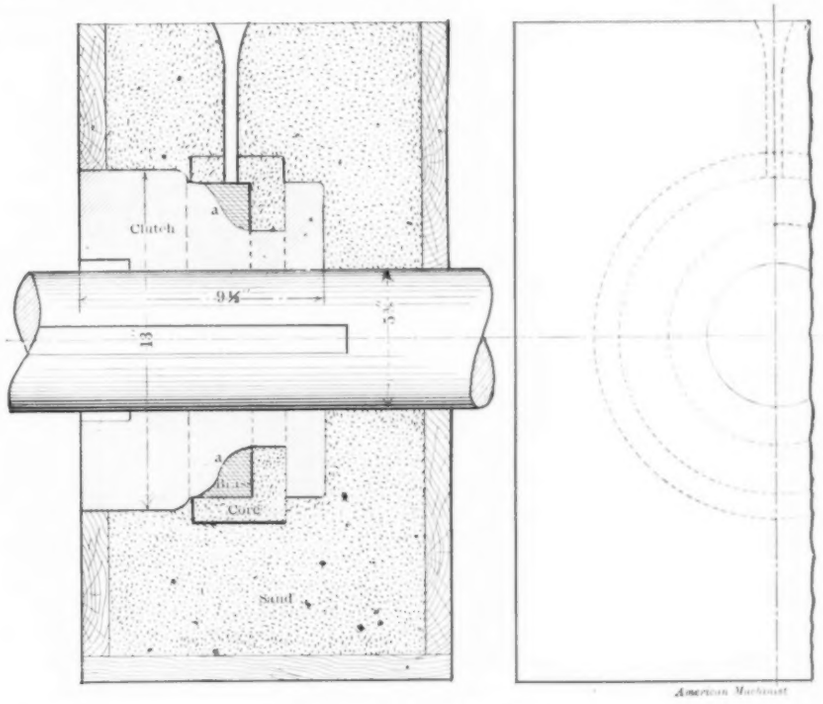
ROBT. G. NYE.

Repairing a Worn Clutch.

Editor American Machinist:

The sketch shows a clutch on a main line shaft 5 3/8 inches diameter, which ran in a pit. The clutch gave us considerable trouble in throwing it in to drive a machine. The groove in the clutch was for the usual clutch dog, which with an arm and lever shifted the clutch to engage in its mate on a large pinion which drove the machine. This clutch dog by constant use (and inconstant lubrication) had worn away the face of the groove, as shown by the curved line *a*. To cure the trouble it was at first thought we would be obliged to replace the clutch by a new one, which would have necessitated the moving of two large machines, taking off one large pinion, removing shaft and coupling, putting on a new clutch and then replacing all. The shaft was run night and day with only fifteen minutes' stop in twenty-four hours, so we were obliged to repair it on a Sunday. The method we adopted was much simpler and the cost nothing as compared with our first idea.

We had a box or flask made in two sections to fit the shaft and enclose the clutch. We braced the lower half up against the shaft and the jaw end of the clutch. The core shown was made in two sections so that it could be placed around the clutch. One-half of the core was placed below and held there while sand was packed around it to hold it firmly. Next the upper part of the flask was placed on and clamped. The upper core was then placed with a hole at the top for pouring the metal. Sand was rammed in, with the gate left for pouring, and then brass was melted and poured without a hitch. The brass flowed against the core and made the clutch as it originally was. When the brass cooled it shrunk to a tight fit. Small projections were chipped off and filed and the job was done. It was successful in every way, requiring only two men to do it complete in about seven hours. W. J. B.

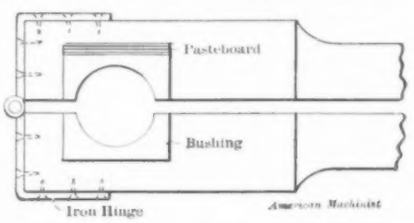


REPAIRING A WORN CLUTCH.

An Improved Polishing Clamp.

Editor American Machinist:

The sketch shows a convenient polishing clamp. The jaws or levers swing upon an ordinary iron hinge the ends of which are bent to conform to the shape of the lever



POLISHING CLAMP.

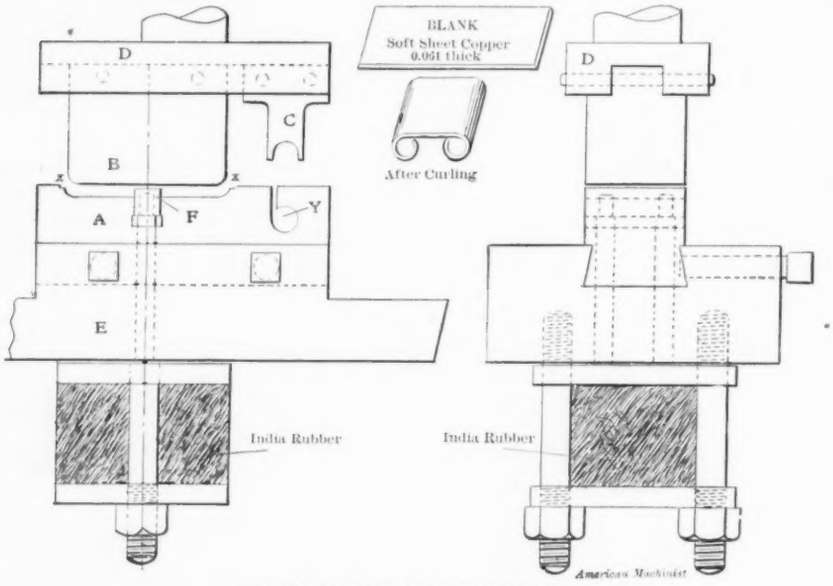
ends, making a much more reliable job than the usual leather strip tacked on to the wood. In the place of clamping the levers together and boring a hole which will fit only one size of shaft, which hole will also be soon worn so as to fit nothing, the levers are cut out to snugly fit a square block of a standard size. These square blocks can be readily cut in large or small quantities, and bored with ordinary bits in a wood-turning lathe, or by hand, and then sawed longitudinally. One polishing clamp

thus made will then be adaptable to a large number of such bushings with holes of different sizes. When the hole in one set of bushings becomes worn by use, so that the lever handles meet, all that is necessary is to replace the old with new bushings, or to pack in pieces of cardboard between bushing and clamp. There is practically no wear out to such a clamp, and the satisfaction resulting in its use is complete. C. B. C.

A Bending and Curling Die for Wire Connectors.

Editor American Machinist:

The die here shown was used for bending and curling the ends of wire connectors. The blank used was soft sheet copper 0.064 inch thick, 1 inch wide, 3 inches long. *A* is the die-block, *B* the bending punch, *C* the curling punch, and *F* the tension pad. These parts are of tool steel and are hardened, thereby adding to the life of the tool. *D* is a mild steel forging machined as shown; the punches *B* and *C* are milled



DIE FOR CURLING WIRE CONNECTORS.

to fit the slot in *D*, being held in position by means of taper pins. *E* is a gray-iron shoe or bolster. The semicircle in punch *C*, also the hole *Y* in die-block *A*, should have a very fine, smooth finish and these should also be in line with each other.

To operate the die, place the blank in the block *A* between the angles marked *X X*, the center of the blank resting on tension pad *F* and the descending punch bends the two ends slightly. Only a slight bend is required, but it should be to the proper radius, however. This first operation is really necessary in this case; the material to be curled being soft copper, it would have a tendency to buckle in the center rather than to curl unless thus first bent. To curl the bent piece, place it in slot *Y* in block *A* under punch C, which descending finishes the connector as shown. When the punch ascends the piece is pushed out edgewise.

WM. F. HOFFMANN.

Driving a Mail Ship.

Editor American Machinist:

Ocean racing to the average marine engineer will never lose any of its charm. It doesn't matter if he is in charge of the crankiest old bag o' tricks of a debilitated tramp or the intricate twin-screw engines of the liner of the present day, he cannot resist the temptation to try her powers against any rival that they may come across on the high seas of the world. It is astonishing to see the way two old tramp ships will plunge along, day after day, at their allowed speed limit of about 8 knots with no particular aim, perhaps, but to be the leader in an ocean race. But ocean racing is seen at its best on the fast mail ships, when getting the mail off, or the pilot, or quarantine, is the goal they are driving for. With about half a hundred men on watch in the engine and boiler rooms, all more or less imbued with the racing spirit, the mail ship can soon be raised from her usual speed to her speed limit, and held so for days, weather permitting of course.

As we have known for days that our rival was running abeam, about 15 miles to northward of us, we are not surprised when she appears over the horizon at noon heading like ourselves for New York. If outward appearance goes for anything, she betrays every symptom of a desire to get there ahead of us, as she drives along with smoke rolling from her funnels and foam breaking from her bows. We accept the silent challenge and await with impatience the word to "let 'er go" which presently comes down the ladder. Soon the word passes thru the boiler rooms, and with the increasing energy of the firemen the steam creeps up. The men gradually knock off jawing one another, as all their spare time is occupied in having a blow under the ventilator. The only sounds heard are an occasional sharp command, the clash of the furnace doors, or the rattle of the firing tools. The temperature of the boiler rooms rises, sometimes to about 130 degrees Fahr., and it is surprising to see how well the men hold out in this intense heat.

Presently the engineer steps into the bunkers, and running his eye over the coal points out the best coal for steaming purposes with the curt order, "Rush it out!" The coal-passers usually work in pairs, a novice being set to work with an old-timer, if possible. Stripped of all but their pants and shoes, skin black as ebony, and dripping with perspiration, they shovel and wheel. They also have succumbed to the prevailing excitement, and woe betide the luckless individual in the way of the loaded iron barrows as they emerge at a run from the bunkers and, dexterously shooting the coal out in front of the furnaces, are off again for another load.

In the engine rooms, where the monstrous four-crank engines are tearing round the engineer in charge is even more on the alert than usual, as it would not do to have anything happen in a crisis like this. His eyes seldom leave the rows of gages as he notes the various pressures recorded, his condenser vacuums and temperatures of his sea injection discharge, feed water, etc. Close to the levers is a telegraph to the bridge, a telegraph to the boiler rooms (humorously pointing to "MORE STEAM") and a telephone to the wheel house. From his position at the levers he sees but little of the machinery beyond the flying cranks, but his assistants and oilers making their reports keep him posted as to how things are running. Every half hour, perhaps oftener, he will take a note of the figures on the revolution counter and calculate the average revolutions since coming on watch. He notes with satisfaction each decimal point of a revolution gained, and sends word to his colleague in the boiler rooms. He also sends a few caustic remarks if the revolutions are not increasing as time passes. He knows and understands the various sounds around him, as each piece of machinery has its own clank or beat, and any change from the usual would at once make itself apparent to his quick ear.

Over the auxiliary machinery the junior engineers keep the watchful eyes of a fond parent, as each individual pump is like the link in a chain, and a slight hitch can set the whole system wrong. The junior knows from bitter experience what a little two hours' sweat on a broken-down feed pump means and, as he goes around, passes his hand over the various nuts and pins on the pump gear.

The latter two hours of the watch see us steaming our best, as we had about twenty fires to clean with their ash-pans and smoke-boxes after we came on watch.

"Eight bells" rings at last and we are by no means sorry to be relieved, as four hours is quite enough for any man. Of course if everything is not working satisfactory we have to fix it, whatever it is,

as we must leave things in good shape. We take an occasional look at the other ship when off duty, and the old argument about her speed limit and horse-power crops up for the hundredth time.

As night closes down and the stars come out, we take a last look over the sea, where away off our beam we can see her lights twinkle, and go to bed with the comforting thought that "we think she seems to be dropping behind." X. Y. Z.

Grinding Parallels

Editor American Machinist:

At page 599 "Toolmaker" says, "If any reader knows of a quicker way, I shall be glad to hear of it." While I have never had a job of grinding eight pairs of self-hardening steel parallels, I have ground quite a lot of pieces of steel, hard and soft, machine steel, gray iron and cold-rolled iron, and as I had charge of the toolmaking department I have had occasion to have many such jobs of grinding done for dies, jigs and tools, also for ring and plug gages.

Some of this work (the flats) was ground by being clamped to the bed of a planer which had been rigged with a countershaft overhead and with a casting to carry the emery wheel put on in place of the clapper box slide. The wheel used was 10x½ inch; both emery and carborundum wheels were used. No water was used, as most of the grinding on this machine was gray iron or cold-rolled machine steel.

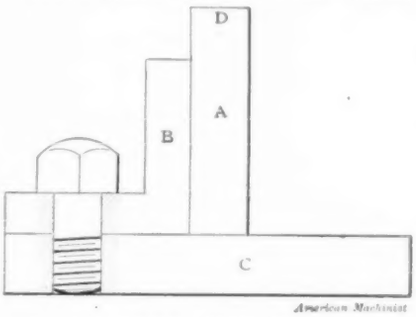
For the parts that were ground and used in the construction of tools most of the grinding was done on a small Garvin grinder that had a table with a T-slot, and altho I made some bolts to be used if wanted they were employed but once or twice in six or seven years. The work was invariably moved under the wheel by the hands. Sometimes, and if the piece to be ground was quite long, up to 30 inches, the man would use a gray-iron parallel which was planed on all four sides and cored out, leaving the walls about ½ inch thick. This was sometimes clamped to the table to prevent any movement caused by the motion of the machine.

While anyone of the four sides of the parallel could be used, it was necessary at times to replace the parallel, as the nearly constant use would wear off the center, and then with a hollow surface the work being ground would come hollow or concave, and .001 inch is quite a space when held up to the light. I have heard men say of a piece that had been ground hollow, "There is space enough to throw a cat thru." Certainly the hollow edge when tested by a straight-edge did look as tho the space was .004 or .005 inch, yet when both sides were ground and with each end the same size, on measuring the center the combined difference would not exceed .002 inch, and frequently it would be less.

I have noticed many times that workmen who use micrometers and work to .001 inch, and often less, can be surprised by taking two straight-edges and placing between them 10 inches from the end a piece of .001-inch thick tissue paper and then holding the straight-edges up to the light. The space of course is wedge shaped, being .001 inch wide at the large or paper end and nothing at the other end, and the space 1 inch distant from the closed end is only .0001 inch wide and every succeeding inch adds only .0001 inch. Two good 12-inch rules are not so very bad to try this effect; besides that they are graduated, and by using two good straight-edges 20 inches long the space 1 inch from the closed end will be only .00005 inch, or 1-20000 inch.

Almost always work that is being moved by hand can be favored by being changed end for end or sideways, and the hands can usually feel the pull of the wheel when cutting, sparks or no sparks. The only thing to avoid is an accumulation of emery dust on the table or plate.

Several years ago a machine builder



GRINDING PARALLELS.

complained to me that he could not get the boxes of his machines planed to suit. They would be of various sizes as to thickness and also have high or low corners. These boxes were to be finished 1 inch thick, and as one size of machine called for twelve of these at one end of the spindle and twelve at the other end, the total of each set to be 12 inches, while another size of machine called for twenty-four spindles or forty-eight boxes which must add up to 24 inches, and as the spindles were about 20 inches long, it is not difficult to see quite a lot of trouble if the boxes did not measure off correctly at each end. As he had a Brown & Sharpe cutter and reamer grinder, I told him how I got parallel work done and afterward found out that he finished his work as I suggested and his troubles ceased.

After reading "Toolmaker's" article I took a piece of self-hardening steel and ground off a little and found the amount ground off to be about the width of a line on the thimble of the micrometer, possibly .0001 inch.

From what "Toolmaker" says, I should judge that he ground two sides to a finish before grinding the edges at all, and, if so, I would suggest that he rough-grind all the surfaces first, the effect being to remove the outside tension, leaving only .002 inch or .003 inch on a side to finish. It is possible to do the roughing cuts with the piece clamped in the vise, but when it comes to finishing I prefer to do the moving by hand.

It may not be out of place to tell how I would start a job of grinding, and if a good start is made the finish will come in good shape. It is next to impossible to get a piece of tool steel entirely free from some kind of distortion. The piece may be winding or it may be curved; the sides may be full so that the center will be thicker than the edges, or the edges may not be square with the sides; it may have a few short or long kinks, the sides and edges may not be parallel, and the piece may have all of the above-mentioned defects and need some kind of doctoring before proceeding with the job.

To commence with, I would get the piece fairly straight, heating it if necessary. Next I would select the best side and, if it was winding, would grind one or both high corners down until I had a bearing at all four corners and no rock. With this as a start I would grind the top side, and if on removing the surface the piece rocked, would grind a corner off until the rocking ceased. Having ground one side I would in the same way grind the opposite side. After a good start rock or wind does not bother much. Having ground the sides I would clamp the piece to an inside angle-plate. This angle-plate is made of two pieces—at least that is my preference—see sketch. The plate should be adjusted so that the edges will be ground square with the sides. If the pieces are thick enough to warrant it, they can be finished without being clamped to the angle-plate, but if thin it will be necessary to clamp them to a plate or parallel to hold them up square. After finishing the edges, the sides can be finished, but take nothing for granted; use micrometer, square and straight-edge.

In the sketch the piece *A* is to be ground at the edge *D*. *A* is clamped to the side of *B*, which in turn is fastened to the plate *C*. With this arrangement *B* can be packed up at an angle by placing a strip between *B* and *C*. G. SCHNEIDER.

Best Steel for Pneumatic Hammer Snaps.

Editor American Machinist:

I have no doubt a great number of your readers have had lots of trouble from the breaking of pneumatic hammer snaps, chiefly in the neck; also from their chipping at the ends. We have had heaps of trouble and could not keep up our supply. Sometimes we tried different makes of tool steel and different grades, but we have gotten best results from steel of low carbon. Our toolsmith suggested trying machine steel case-hardened and potashed. We made a dozen and have had such good results that we now make them all of soft steel. These snaps have driven thousands of rivets and have had only one break. This means considerable saving in cost of steel and

also time in machining. I would advise anyone having trouble to try this.

CANADIAN TOOLMAKER.

A Taper Gage—Inside and Outside Scratch Gages—Drill Holder.

Editor American Machinist:

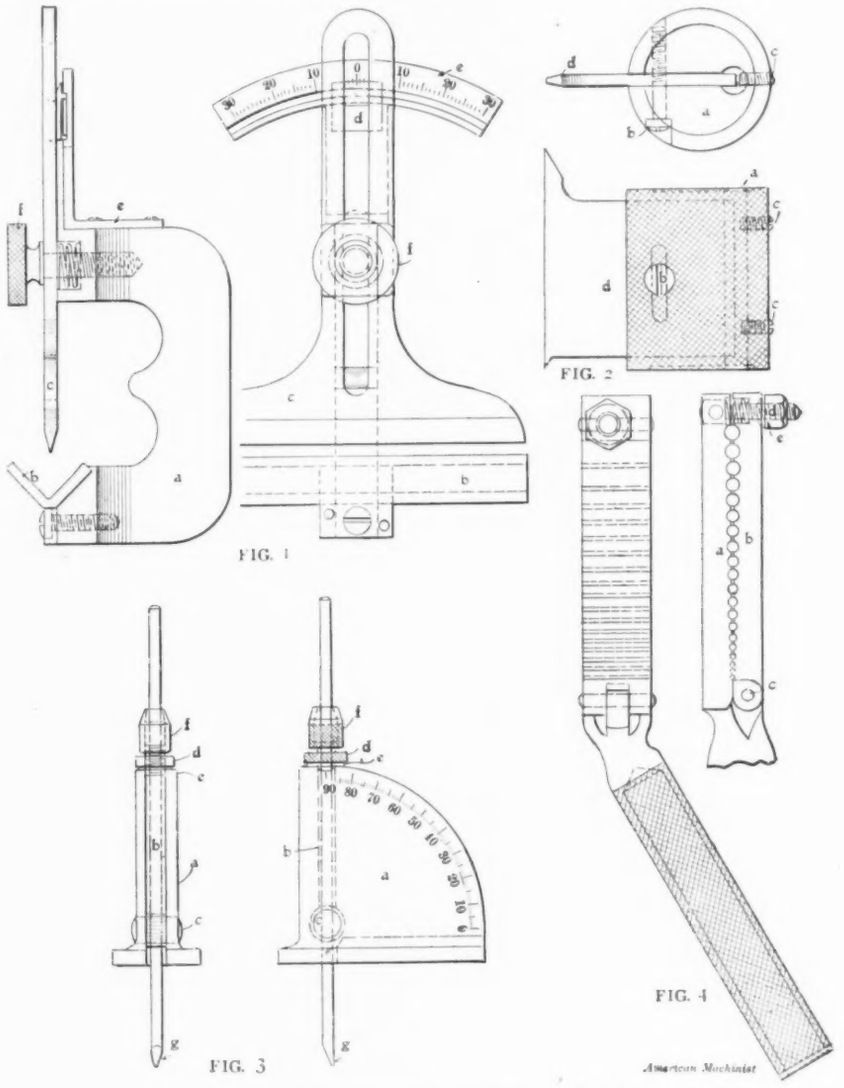
Some years ago I read in the AMERICAN MACHINIST of a taper gage similar to the one shown here, and I have since seen it in different shops throughout the East, but it could not be again set exactly to any given taper when once changed to another. The little device here shown, Fig. 1, has proved itself very valuable at times when different tapers have been required. By the use of this taper gage the cut-and-try method of fitting to a templet, collet, arbor, or any other kind of work where duplicated pieces are wanted, is avoided. The slightest difference of the taper can be seen by reading the graduations on the slide *d*.

The handle *a* is made of gray iron or brass; it is shaped for the fingers to lie in and at the back it is rounded to give it a comfortable grip. It has a V-shaped piece *b* at the front fastened with screws and two dowel pins. This is made of mild steel, case-hardened and lapped straight on the face inside. On the upper projection of the handle turns the blade *c*. This is made of tool steel hardened, ground and lapped on the edge. It has an elongated slot in the center where the screw *f* holds it in position. Under the blade is placed a special spring to keep it from dropping, and to hold slide *d* in the curved slot while setting. On the top of the handle is fastened the angle piece *e*. This has a graduated quadrant in front and a circular slot 3-32 inch deep and 1-16 inch wide, in which rides a tongue of the slide *d*. When graduating this plate have a line on each side of the zero line divided in fine equidistant spaces to match corresponding graduations on the quadrant. By the aid of these marks the taper can be set and reset with almost a certainty.

Fig. 2 is a surface scribing gage. This is very simple in construction, but valuable especially when a line is to be scratched to the outline of a piece upon a flat surface below it. It is difficult to scribe such a line and hold the scriber perpendicular if there are curves or angles on the sides. Place the gage on the surface to be marked. have a piece of paper about three thousandths of an inch thick under the face block, set the scriber at an angle or square as required, and when the paper is taken off it will scratch a line exactly around the outside of the work. If the outline is circular, keep the gage radial at all times. The block *a* is made of machinery steel case-hardened and lapped on each end. Screw *b* is used to bind the scribing blade when a great angle is wanted. When the scriber is square the two screws *c c* holds it in position against the screw *b*. The blade *d* is made of tool steel hardened, ground and lapped on the rounded edge. One end is longer than the other, in order to scratch lines on work below the surface.

Fig. 3 is another surface scratcher for inside work where a gage of the other kind will not enter; it can also be used as a depth gage and for other purposes. It comes in very handy where holes of irregular shape are to be scratched from a pattern. The base *a* is made of tool steel hardened, ground and lapped on the surface. It has a 5-32 inch slot thru the center and in the front only deep enough to allow it to swivel at an angle of 90 degrees. In this slot rides on the pin *c* the spring chuck holder *b*. This pin, which is of large diameter, has a turning fit in the holes on the sides, with a free cross-hole thru it in the center for the scriber. On the upper end fits a locking nut *d*, with a washer *e* underneath bent down on one side to show the graduations, this also keeping it from turning. The top of the screw forms a split chuck which grips the scribing rod. The nurled cap *f* tightens the split chuck to hold the scribing rod firmly. The scribing rod *g* is flattened on one side at an angle of 60 degrees. This will allow it to come in right alinement with the work to be transferred from.

Fig. 4 shows a drill holder which is very convenient when holes of different sizes are to be drilled in succession. With this holder the operator can feel the tension on the drill and is thus able to prevent many breakages. It is made of two pieces of tool steel hardened to a spring temper. The nurled handle *a* is drilled out in the center to make it light. In the middle of *a* is hinged the other piece *b* with a pin *c* thru it. On the upper end is placed the screw *d* with a pin thru its center; this screw has an easy fit in the hole. Between the two bodies is a spring to keep them apart. The end of the screw fits the nut *e* which has a spherical base, this giving it a good bearing in either the open or the closed position. When the drill holder is assembled it is laid out in eighteen different spaces running from No. 1 to No. 60 drill. After the holes are drilled each end of each is countersunk with a 60-degree angle, to serve as a center when drilling, the faces of the two parts are planed or ground off on the inside



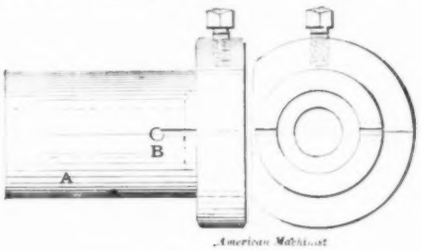
TAPER GAGE—SCRATCH GAGE—DRILL HOLDER.

1-64 inch on the large hole end and three-thousandths on the other end; this allows for clamping the drills or reamers firmly, which is done by simply tightening the nut. A. L. MONRAD.

A Chuck for a Special Job

Editor American Machinist:

The accompanying sketch shows a good way for making a master chuck when the



CHUCK FOR A SPECIAL JOB.

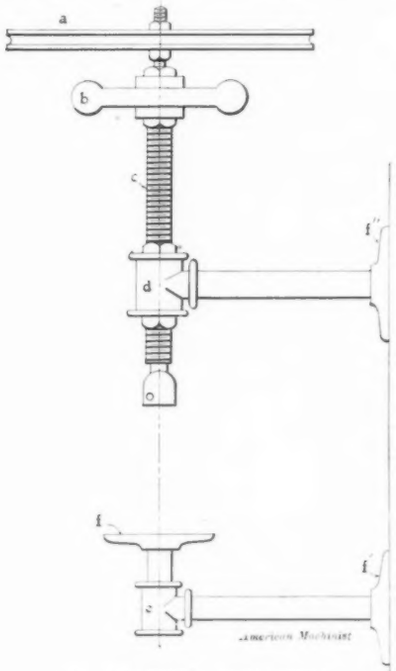
work to be done does not require a permanent and more elaborate affair.

The body of the chuck is clamped in the regular lathe chuck at *A*, a hole being drilled at *B* and the chuck slotted or saw cut as shown. An old shafting collar serves as a clamping device to the work, allowing the work to be removed and replaced in the chuck as it goes through various operations. A. H. E.

An Amateur's Drill Press.

Editor American Machinist:

The sketch represents a simple and inexpensive amateur's drill press. *a* is a sewing-machine drive wheel, *b* a hand



AN AMATEUR'S DRILL PRESS.

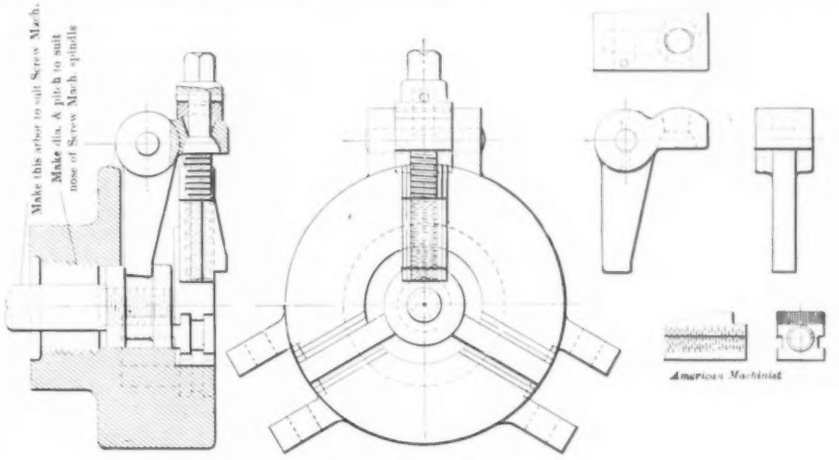
wheel such as is used on a 3- or 4-inch globe valve, or the driven wheel from a sewing-machine head, *c* a piece of 3/8-inch brass pipe threaded its entire length, *d* a 3/4-inch T bushed and bottom with 3/8-inch bushings. The hand wheel *b* is fastened to the pipe *c* by pipe lock nuts. The drive wheel *a* is fastened by lock nuts to the steel rod or drill spindle that passes thru the brass pipe *c* by lock nuts, the drill chuck being fastened to its lower end; *e* is a 3/4-inch T which allows the chips and oil to pass thru; *f f' f''* are pipe floor plates. A long driving belt is used, thus allowing for the vertical movement of the drive wheel as the drill is fed to the work.

WILLARD F. SHEAF.

A Special Chuck.

Editor American Machinist:

Illustration shows a special chuck we made and fitted to a turret lathe for the manufacture of switchboard terminal nuts and other hexagonal work. This chuck allowed the work to be done fairly accurately and quickly and also allowed



A SPECIAL CHUCK.

for some variation in the castings which were chucked. The blueprint I think explains all fully. It was operated by using the draw-back clutch in the usual manner, the machine being thrown into slow gear by friction clutch for chucking and into fast speed for turning and facing.

NOMAD.

The Catalog Part of the American Machinist.

Editor American Machinist:

When L. L. Arnold (page 465) wrote on the catalog, meaning the advertising in the AMERICAN MACHINIST, he touched up my memory some. I used to kick—and pretty badly, too—at having to carry home half a ream of somebody else's rubbish, which, like lots of other things in this world, you'd got to have, whether you wanted it or not. I never could see the use of it. It seemed like a railroad sandwich that you get in the old country here—lots of hard tack and not enough of the real stuff in between. I did not stop to think that all that advertising kept down the cost of the paper to the subscribers. One day I woke up. At the shop the boss came along and asked our foreman about a certain planer he had heard talked about. He had been told it was a top-notch planer, and if the price was good, maybe he'd buy one; but who was the maker? He and the foreman tried pretty hard to locate it. I heard enough to get the points of that planer firmly fixed in my mind, and I thought it was a pretty swell machine—rather different to our old scrap. As the boss seemed anxious to find the maker, it occurred to me that it might be somewhere between the leaves of those self-same copies that had caused such a heap of bad language. After supper I lifted off a pile and waded in to find that planer. I had nothing to go by except those features I had heard the boss discussing with the foreman, and as some of them were internal ones, they could be got at only by reckoning up the gear outside. So I started in from the front page and sized up every planer I came across. After a while I took quite an interest in them and used to reckon up how they would pan out on jobs I had to do. There were some planers I could not reckon up at all, so I made notes to write to the makers and ask all about them. In a while I found that planer the boss wanted. There was no mistaking it, so I wrote the makers to send me all particulars and gave our foreman a hint that he might get what the boss was after by writing to a certain concern. My catalog came along all right, and a lot of descriptive information as to what the tool would do. Now I could see it was a good thing and was built to work at twice the speed our old chip scraper would cut at. I talked its good points over with the foreman and he talked the boss into buying it. When that machine came along I got the job of running it, and also got a raise to induce me to run it at its best. I soon found out its good points and that I was beating the other boys by getting more work thru, so I devised some rigs for crowding as much on the table as possible and cutting down the time of setting the work.

Since then I wade thru the catalog carefully each week and linger over anything which presents any new features. If I want further information I write and get it.

Now I am interested in other things

than planers, but I am always glad when the boys come along and tell me about something that they have read about in the AMERICAN MACHINIST which they think would do a job better than the old way. So that you see it is not only the buyers and sellers who make capital out of the catalog. JAYMAC.

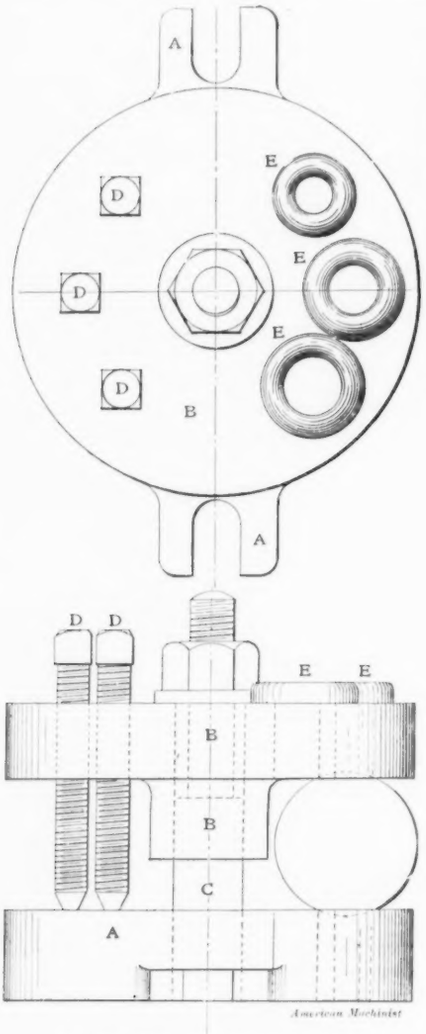
England.

Jig for Drilling Round Balls.

Editor American Machinist:

The accompanying sketches show a simple jig or fixture for drilling holes straight thru the centers of round balls, such as governor balls for steam engines, round knobs on the ends of locomotive pillars for hand rails, etc. To do this work without some special fixture is rather difficult. The base plate *A* is a round casting with two ears cast on for bolting down. The top plate *B* is a similar casting with a hub. This is bored to fit the turned stud *C* which is screwed fast into the base plate. The upper end of the stud is reduced in diameter, as shown, to allow a smaller clamping nut to be used, and also to allow more room on the top plate. *E E* are the hardened bushings to steady the drills and *D D D* are the adjusting screws for setting the top plate level for different sizes of balls. When a round ball or knob is put into the jig and the top plate is clamped down as shown, it is impossible for the drill to run out of the center, as the ball locates itself central with the hole in the bushes. The jig illustrated is intended for drilling three sizes of holes, each bushing being a different size. J. DOWNING.

England.



JIG FOR DRILLING ROUND BALLS.

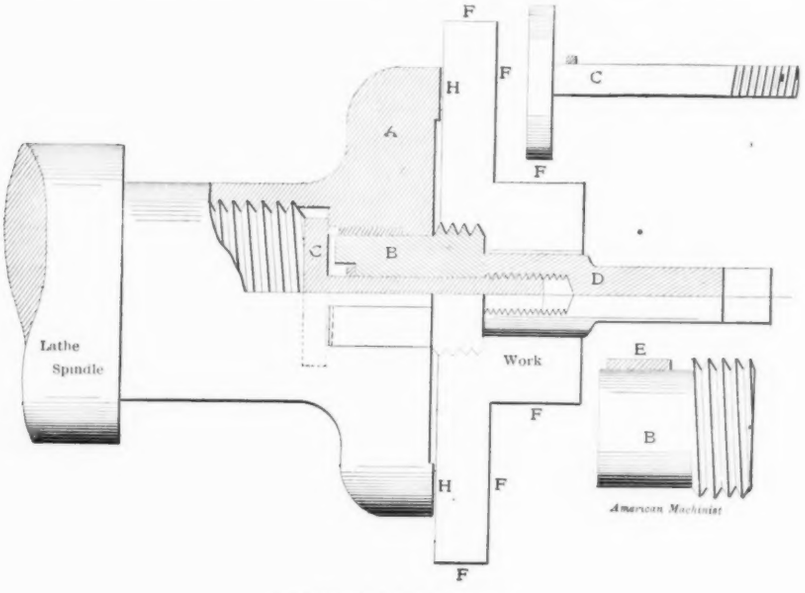
A Releasing Screw Chuck.

Editor American Machinist:

During an extensive experience in machine shop practise few devices have rendered better and more economical service than this screw chuck. In the facing and turning of stuffing boxes, or in work where the same principle can be applied, the threaded mandrel was unsatisfactory and could not be used on all turret lathes. When the piece was finished much difficulty was encountered in unscrewing the work. The carrier had to be struck many blows of a hammer to start the unscrewing of the stuffing box. In this device this trouble is obviated, with much saving of time and proportionate decrease in the cost of production.

This screw chuck is suitable for an engine or turret lathe. It consists of the part *A*, which screws on to the lathe spindle. The stud *C* is passed into *A* before the latter is screwed on to the lathe spindle. The loose sleeve *B* with the key *E* being introduced over *C* through the hole in *A*, the sleeve-nut *D* is screwed on to the stud *C*. The piece to be operated on is passed over *D* and screwed on the loose sleeve *B* until the faces *H H* come in contact. The sleeve-nut *D* with a wrench is now tightened, forcing the two surfaces *H H* together. The stuffing box is now turned and faced. To remove it, simply release the sleeve-nut, which permits *B* to slip forward loosing the contact surfaces *H H*, when the work can be removed by hand. The dimensions of this device depend upon the size of the work to be done and the calibre of the lathe spindle. EDWARD C. CONLIN.

Bordentown, N. J.



RELEASING SCREW CHUCK.

The Motors That Drive the Betts Tools at St. Louis.

Editor American Machinist:

In your article entitled "The St. Louis Exhibition—VII" we note in Fig. 2, page 890, that the 15 horse-power motor is credited to the General Electric Company. Fig. 1, at page 891, however, which is a photograph of the same machine, shows the motor to be one of our own.

At page 892 the 7½ horse-power motor driving the Betts horizontal boring machine is credited to the Northern Electric Company. Fig. 5, showing this machine, reveals the fact that this motor was built by the Crocker-Wheeler Company.

We regret that these errors should have occurred in this article. Our Form I motor, of which these two photographs furnish good examples, has been found well adapted to this sort of work and to a great many other kinds of service; especially when used with the Crocker-Wheeler multiple voltage system of speed control.

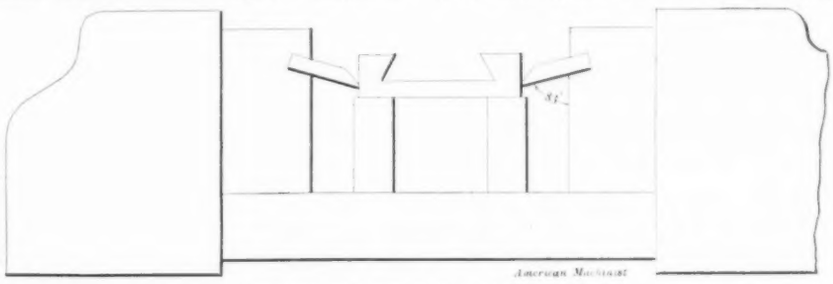
These examples are of the fully enclosed type suitable to the machines they drive. CROCKER-WHEELER COMPANY.

[In Fig. 2 we simply copied a legend which was on the blueprint furnished us by the Betts Machine Company, and in the case of the horizontal boring machine took for our authority a statement written upon the back of the photograph by a representative of the same company, taking it for granted that this would be correct. We of course had no other object than to give the facts of the matter.—Ed.]

For Holding Planer and Shaper Work.

Editor American Machinist:

I have noticed and used several methods of holding down work in shaper and planer vise, but I have never found one that could compare with the one shown, which I have used for some time, with entire success. It is simply a couple of parallels with a 3-16 slot cut into them at about 83 degrees from the face, and a beveled piece of steel set into it, or, if the sides be rough, several short pieces may be used.



FOR HOLDING WORK IN PLANER VISE.

It helps to attain accuracy, for it holds work down on parallels, thus insuring parallel sides; or to get one side square with another, just one may be used for holding up against the side of the vise.

Being thin on the edge it holds down, and being set into parallels it cannot kick up as loose keys do. Its most commendable point is the time it saves—simply bring the vise up and it is there; no tapping down is necessary, and for special work—duplicate parts—it is unexcelled.

L. W. S.

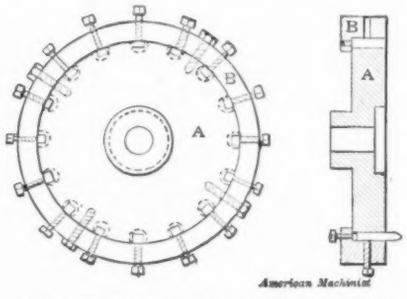
[Arrangements that work on this principle have long been used in some shops and we have illustrated some of them, but the plan of inserting the pieces within parallel strips is not so common and is an improvement.—Ed.]

Another Facing Mill With Inserted Teeth.

Editor American Machinist:

At page 731 L. A. M. shows a facing mill for a similar purpose for which I made one recently. I think my design has a few advantages over his. *A* is the body of gray iron; *B* is a ring, also of gray iron. The body was bored and turned on an arbor in the usual way, and the square grooves for the seats for the blades milled. Ring *B* was made an easy driving fit on the rim of *A*. After the set-screw holes were located, drilled and tapped, the ring was driven on and four cap-screws tapped thru it into *A*, so as to make sure of its staying on. You will observe that on the back of *B* there is an ear or lug behind each blade (the blades in mine are made of ¼-inch-square self-hardening steel). These lugs are tapped and a screw placed thru them to abut against the back end of the blades. As our milling machine has no threads on the nose of the spindle, I had to devise another method of holding the mill. We have one of those abominations, an end mill that screws on to its arbor. I used the arbor for this mill, boring the hole in the hub to fit on the large part and making a round nut to fit into the large part of hole in the mill, which I set up with a prong wrench. Now for the advantages I think mine has over L. A. M.'s. First, I think it cheaper to construct; second, there being no back plate, it comes nearer the bearing of spindle, so is more rigidly supported; third, if any or all of the screw holes become worn out, you do not have to throw the whole thing away, just fit a new ring on it and it is as good as new.

D. W. Rogers.



ANOTHER FACING MILL WITH INSERTED TEETH.

Punching Hexagon Nuts in Sheet Brass.

Editor American Machinist:

The nuts produced by the die here shown are made of ⅛-inch hard sheet brass and, after being tapped in the machine, are used on a certain novelty which requires 50,000 a day. Nine nuts are punched at each stroke of the press without waste of stock, and the efficiency of the punches can be appreciated from the fact that they need not be ground oftener than twice a week.

The nine cutting punches *a* are driven into the punch holder *b*, which is secured to the press by the slot in the stem in the usual manner. The four hexagon punches *c* also are driven into a shoulder, the holes go thru on one side of the punch holder so that the punches can be driven out when required. The cutting-off punch *d* is not shown in Fig. 2. It is secured in a slot with a screw at each end. Four guide pins *e* are driven into the four corners of the punch holder and secured by screws *f* which have 60-degree points, so that the guide pins will not have a chance to turn. On each of the two guide pins in Fig. 1 is fastened half of a hexagon shaped punch. This is driven into its place in the slot provided and held in position by a screw *g*. The pins are made of tool steel and hardened, ground and lapped to a perfect fit in the die holes *j*. These punches shape the outside edges of the sheet brass. Into two of the hexagon punches pilot pins *i* are driven, but so that they may be taken out when required. These act as locaters when the punches come down, as the metal must lie exactly to obtain good results.

In Fig. 1 the guide pins are taken off to show the punches clearer. The die *k*, Fig. 1, is laid out in the regular way, and the

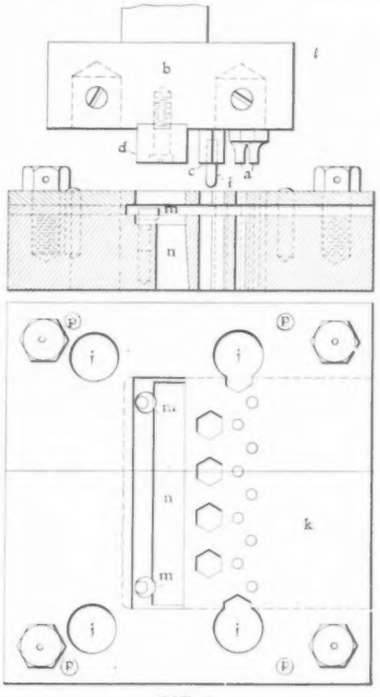


FIG. 1

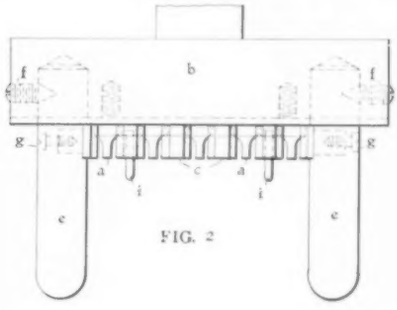


FIG. 2

FIG. 3

MATCH DIE AND PUNCH FOR HEXAGON NUTS.

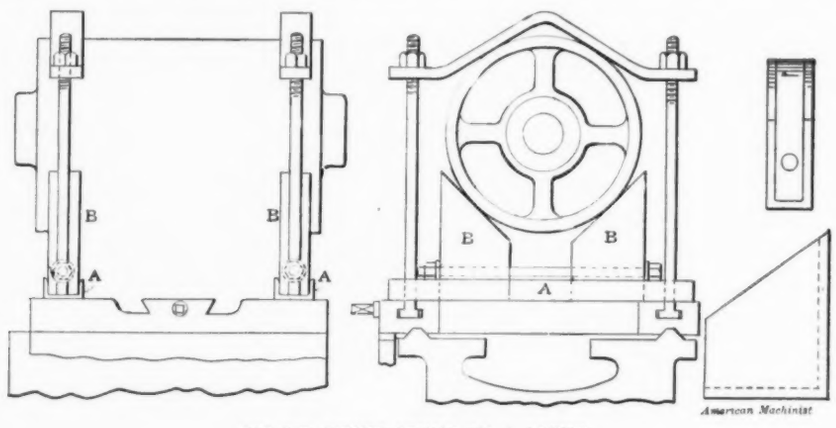
blanking holes are drilled at equal distances. For this work a perfect templet like the sample blank shown was made to match the die with test plugs and to fit and lay out for the punch holder, giving the die only a slight clearance to permit grinding without changing the shape and size to any appreciable extent. The oblong cutting-off hole or slot *n* is finished as shown, with one side tapered to give plenty of room for the blanks to drop thru. On each end of this hole on the top is placed a stop pin *m*. These pins have eccentric heads to make room for the drop-hole *n*. Under the stems of these pins are spiral springs to keep them up level with the top of the work. When the cutting-off punch comes down it presses the pins below the surface, they rising again when the punch goes up, and at the same time acting as stops for the work. After drilling and tapping the holes for the stripper-plate screws *o* and letting in those for the four gage-plate dowels *p*, the die is hardened and tempered in the usual way, drawing it to a light straw. To start the work pierce two rows of holes first by letting the end of the brass come to the edges of the punches. On the next stroke the pilots will locate it in right position and with the third stroke the first blanks are finished.

A. L. MONRAD.

Rig for Boring Drums on a Lathe.

Editor American Machinist:

Having a quantity of gray-iron drums for calender rolls about 3 feet diameter and 4 feet 6 inches long, with bosses at each end to bore on a lathe, we made the rig here shown. It answers its purpose admirably and for simplicity and usefulness it would be hard to beat. It consists of two short sections of rolled channel steel marked *A*, laid across the carriage, and four gray-iron blocks *B* which just fit in the channels. These blocks are cored out and are only ¾ inch thick. They are adjusted by the bolt passing thru them, as shown, tightening which raises the drum to the required hight, the straps on the top and the bolts pasing down the sides thru the channels into the T-slots in the saddle making all secure. The bosses are then bored out by a bar on the lathe centers in the familiar way.



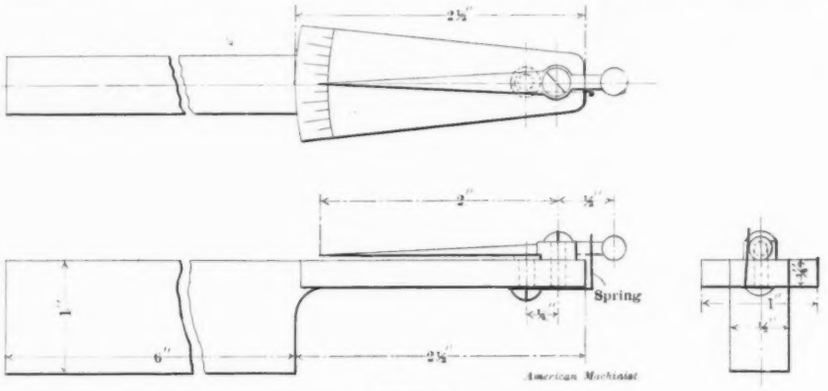
RIG FOR BORING DRUMS IN A LATHE.

C. H. ALEXANDER.

Another Indicator.

Editor American Machinist:

I made this indicating tool which I send a sketch of. I took a piece of ½x1-inch iron and had the blacksmith forge it to the shape I wanted. I then made a small pointer with a ball on the end of tool steel, then I made a spring out of a light piece of brass wire and fixed it to rest against the pointer. This tool shows about four times the amount that the job is out, and it is very easy to set the job true.



AN INDICATOR.

CHAS. SEHL.

A Mechanical Spook.

Editor American Machinist:

It was the eve of All Souls, when at the stroke of night's high noon the disembodied spirits of the departed roam once more on earth and visit again scenes and mortals dear. I was working late that night, and as I labored on unmindful of the hour, my reveries were rudely broken by a tall, well-knit Ethiopian who forced his way into my little shop supporting with his trembling hands an aged and infirm cushion-tired bicycle. With chattering teeth he inquired, "Is yo' de bicycle machinis'?" "Yes," I replied, "what is the matter?" "Well, yo' see, boss, disyer wheel am hoodooed, et's full o' hants." It was then I noted the palsied hands and ashy green complexion of the African. "How do these hants assert themselves?" "Well, yo' see, boss, et's disyer way: Ah's a-gwine down Coopah street; ah hed jest ben up to see mah baby, Miss Verdal Watkins, an' ah's a-feeling kind o' bresk, when ah struck Coopah street, so ah thout ah'd let her out a bit; ah hadn't gone mo'n thirty feet, when flip! summin hit me just whar ma ol' mammy use ter. Ah looked roun' an dar worn't noffin dar, so ah jes say quiet to ma self dat wor a stone King David Jones, doan yo' take on 'bout dat. So ah rides right 'long slow fer a bit twell ah comes to a fine piece o' road an' ah lets her out agin an' agin ah gits a crack in de same place. Den ah knowed it uz de hant o' mah ole mammy, for she done tole me 'fo she die, 'You King David Jones doan yo' all hab nuffin to do wif no bicycles; dem's fo' white folks.' An' she wor powful sot agin ma spohtin' roun' wif de gals. So ah guess me gwine ter see Miss Verdal an' comin' home on a bicycle was mo'n mah ole mammy could stan."

So I looked the hoodooed bicycle over and told him to leave it, saying that for the sum of one dollar, I, being an adept in the black art, would intercede with the shade of his mammy. He left the wheel and I, with the aid of a divining rod of wire placed between the cushion tire and the rim of the rear wheel, discovered that the tire was loose on the rim almost one-third of the way round. When King David got a moderate degree of speed up, the centrifugal force caused the tire to leave the rim at the uncemented part and it hit him just where his old mammy used to: the upper rear forks, as the wheel revolved, returned the tire to the rim.

I cemented the tire to the rim and thus for a time at least, laid the ghost of King David's mammy. Thereafter my fame spread and the colored people for miles around brought work to me.

DIXIE.

Correspondents who discuss matters in our columns or who refer to articles that have appeared will confer a favor upon ye editor if they will specify the number of the page on which the article referred to is to be found.

Mr. DuBrul on the Cause of Strikes.

At the Pittsburg meeting of the National Association of Manufacturers, Ernest F. DuBrul, who at the time of the meeting and until recently was commissioner of the National Metal Trades Association, made some remarks about strikes and their causes, which remarks are being widely quoted and in some cases in such a way as to be somewhat misleading. We have thought it advisable to reprint Mr. DuBrul's remarks complete so that those of our readers who are interested may know just what he actually said. At first the subject of insurance (of employers) against damage by strikes was being discussed and Mr. DuBrul then said:

"I have given the matter of strike insurance a considerable amount of thought ever since the Louisville plan was started, and since this Waterbury plan was started. In the last four years, and particularly in the last two years, I have had considerable experience in handling strikes. There have been about sixty-five strike cases that have come under my notice in the last year, absolute strikes that I had to do with. In addition to that there have been a great many others that I have followed very carefully, and I want to say to the gentlemen assembled here that my experience is that most of the troubles and strikes are caused by the employer, and I want you to let that sink in pretty thoroughly. I should say, as a rough estimate, that about 80 per cent. of the strike troubles that have come under my notice are directly or indirectly the fault of the employers and are due to laxities or imperfections or rottenness in the management of the concern that has the strike. The other 20 per cent., in a rough classification, are what may be called epidemic strikes that almost anybody is liable to have.

"Now, you take a man who has a well-managed business, who is treating his people fairly, who is not trying to gouge every last cent out of them in the way of wages, who not only talks about a fair day's work for a fair day's pay, but who knows what a fair day's work is—and I want to say that I have found employers who do know what it is—such a man does not have the trouble with strikes that the other man has, and you cannot interest him in the strike insurance proposition by the same token. If strike insurance is brought about for the purpose of supporting the sort of people that Mr. Fay speaks of, the small and weak man, I agree with him that man ought to get some kind of support; but I have also found that the small and weak man is just as liable, if not a little more liable, to have strikes. I will not say that all small manufacturers are small minded; in fact, I know some very large ones who are small minded. But it is a personal proposition, and I would undertake to say that if you were to put a man up against a strike insurance proposition and say, 'Here, you have got to have such and such qualifications,' just the same as the New England Mutual people say to him about fire insurance, the average man would say, just as he says to the New England Mutual Fire Insurance people, 'Why, that costs too much. I will carry this risk myself,' and you cannot afford to carry the risk for him unless he is first-class. That is just the idea that I want the committees to think about.

"Now, these committees, when they get down to a plan for either strike insurance or fire insurance, will require the expert assistance of some very good men, and the more they can learn from practical insurance men, the better they will be able to do. But I want to cite this fact that these committees must look after. Everybody thinks he himself is all right. That is my experience in this world, and it is pretty hard to convince him otherwise, especially from the outside."

As might be expected, this statement was sharply attacked by other members of the association, and in reply to this attack Mr. DuBrul said:

"Mr. President, a word of personal explanation. Mr. Ittner is correct when he says that 90 per cent. of strikes are caused by organized labor. Of course they are. You could not have a strike without organization. That is a self-evident proposition. I do not disagree with him there. But why did the organization get a foothold in the shop? Why does agitation get hold of the men enough to interest them in the organization? As I say, in most cases it is the employer's fault. Twenty per cent. of the cases are what I call epidemic. With the other 80 per cent. it is the employer's fault, either directly or indirectly. Take the case of piecework. You find all the unions objecting to piece-work; and I do not blame them. The president of the National Metal Trades Association, for instance, when he was a machinist at the bench started to work at piece-work in a very well-known establishment. He was an exceptional man. He had to be in order to become the superintendent of the works that he is, and practically the dictator of those works. He began to make more money than the average man. When he made four dollars a day he was cut back to three. He hustled along and devised another scheme here and there to make four dollars and a half a day, and he was cut back to three again. And that is going on under the piece-work system all over the country, and you know it."

Mr. Ittner: "No, I do not know it."

Several members: "No! no!"

Mr. Nissen: "I rise to a point of order that this question at this time is not germain to the subject of insurance."

Mr. Fay: "There is no motion before the house. It is entirely informal."

Mr. DuBrul: "What is the ruling, Mr. President?"

The president: "Go ahead."

Mr. DuBrul: "Now I want to call the attention of this convention to a phase of management that has been going on in a number of institutions in this country in which the association, I think, should become interested; that is, its members should; and that is this: There is a certain gentleman who determined that there was a way of finding out the maximum output of any particular tool of any particular man, even on common labor, making proper allowances, not squeezing him, not killing him with overwork, but making proper allowances for necessary rest, and so on. He said to himself, 'There is somewhere a scientific foundation for piecework,' and he got it. He has been studying the problem, and others have been studying it. It has been going on for twenty years. They studied what a man could do. They made thousands and thousands of observations on different classes of labor, and they found some very interesting things. The first thing they found was that the average output of the average man was anywhere from one-half to one-fourth, and in some cases one-sixth, of the possible output of a first-class man doing the same work. Now, that is a staggering proposition. As one of the speakers said yesterday morning, when he was giving us statistics about Pittsburg, 'Do these figures jar you?' Well, this fact jarred him, and it has jarred many another man under whose observation these things have come. They found, for instance, in handling pig iron at the Bethlehem Steel Works that one big, strong, strapping fellow could handle about four times as much pig iron in a day as the same man had been handling previously, but he was not getting the same pay.

"They found another thing: that you cannot get out that extra output for the average pay. The logic of the situation is simply irresistible. If you have a first-class man working alongside of a loafer, and they are both getting the same pay, the first-class man says, 'Why should I work any harder than this fellow has to work to hold his job?' and he simply slows down.

"They found another interesting thing, which has also been found by Mr. Halsey sitting here, the originator of the premium plan that is being used, that when you give an extra reward to men of exceptional ability you can get an extra output, but you cannot get it unless you give the extra reward. They tried picking a crew of exceptional men, and making their whole force first-class men, but when they paid the average pay they could not hold them, because those men would go to some other shop where they did not have to work so hard for the same money. Mr. Halsey has devised a premium system, taking the average production and offering extra rewards for the men of extra ability. Under that system people have been able to get out the extra production, and lessen the cost and save money. Those are the things people have to study.

AUTOMATIC MILLING MACHINE FOR ROUNDING THE ENDS OF GEAR TEETH.

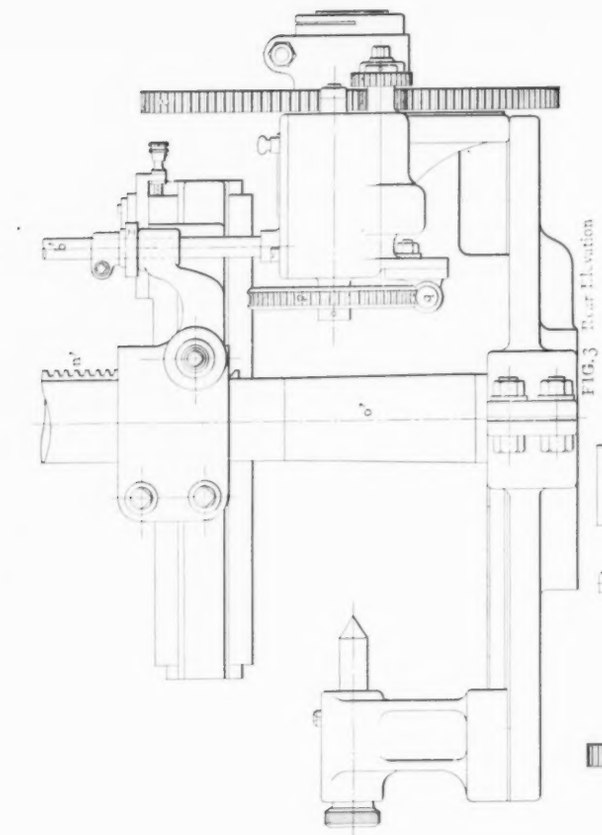


FIG. 3 Rear Elevation

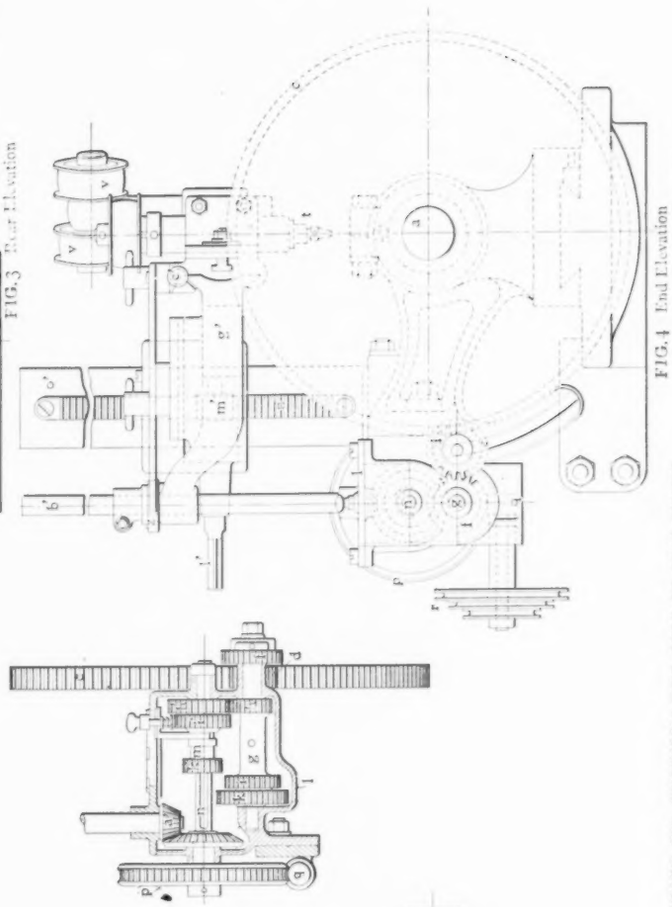


FIG. 4 End Elevation

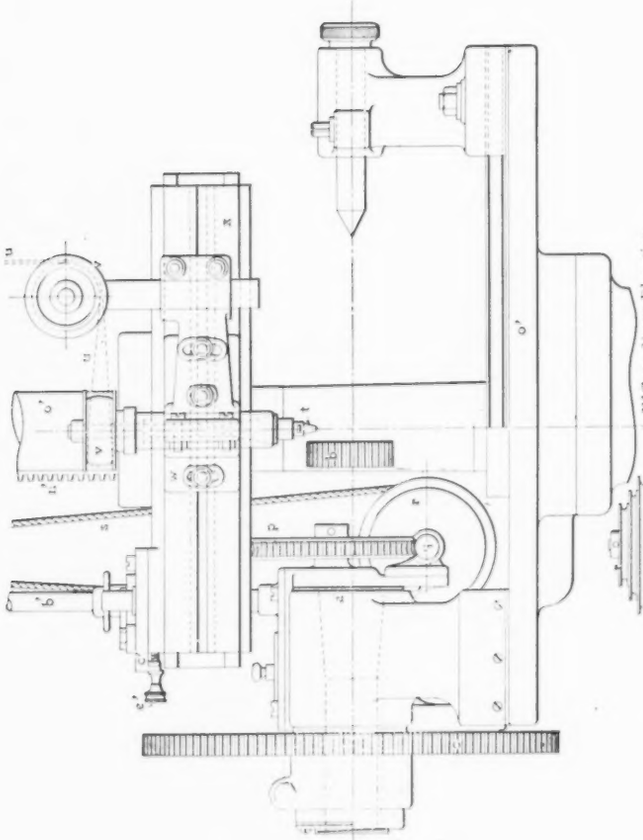


FIG. 1 Front Elevation

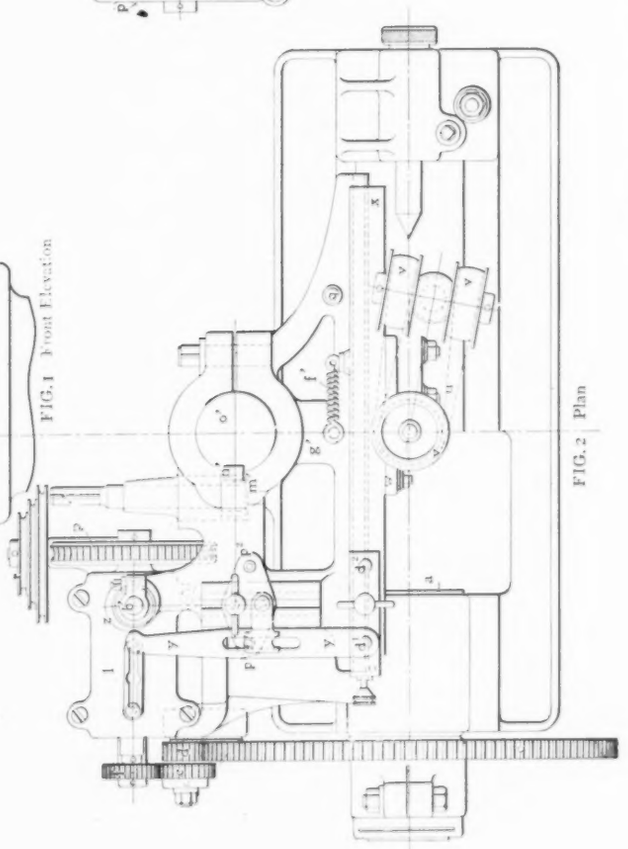


FIG. 2 Plan

"Now, coming back to the strike insurance proposition, the establishment that has some kind of a premium system, that selects its men and pays each man absolutely according to his work, no guesswork about it and no favoritism, is not likely to have much trouble from strikes. We must remember that the foreman is the direct representative of the employer, and the foreman is another man that the manufacturers have got to look after. Any quantity of our troubles are caused by our foremen, and we do not know it. Those are things you have got to study, so as to try to pay each man according to his output." (Applause.)

Mr. Ittner: "May I be permitted to put a question to the gentleman?"

The president: "If he does not object, yes."

Mr. Ittner: "The gentleman has just made a statement in which I concur, that is, that we must look out for our foremen. I would like to ask this plain question of Mr. DuBrul: Under organized labor as at present run, whom does the foreman represent, the employer or the employee?"

Mr. DuBrul: "He is supposed to represent the employer. If he does not, it is the employer's own fault, and if the employer has not got the right kind of a representative, that is his own fault, too."

Finally, in further explanation Mr. Du Brul said:

"Mr. President, the statement that I made this morning seems to have been misconstrued by a great many of the members here, and I wish to make an explanation. I stated, I think, if I can recall my exact words, that in my experience with strikes and labor troubles 80 per cent. of the troubles that came under my observation were directly or indirectly the fault of the employer. A number of gentlemen have shown me where that statement should be explained. Citing Mr. Davenport's illustration, that he gave just a minute ago, of this bakers' strike, I should say that the present strike of bakers in Boston was very largely the fault of the master bakers of that city. They had an organization, but they had been apathetic; they had been indifferent. That was one of their troubles. In other instances that have come under my notice, as I said this morning, there has been a foreman who has not done right. He has ill-treated his men, and so on. The employer is responsible for that foreman. I know of cases where strikes in their last analysis are demands for better management of the institution. It is a well-known fact that the better managed an institution is, the less liability there is in that institution to strikes. My statement was entirely misunderstood. I thought I had made sufficient qualifications in my remarks this morning, and I hope that the gentlemen present will take that statement in the spirit in which it was given, as a warning to them that they must educate themselves; they must educate their employees; they must educate their foremen, their superintendents and everybody else connected with the handling of labor; and, above all, they have got to educate the laboring men. If they do not, it is their own fault very largely."

It will be perceived, we think, that what the speaker said about "whose fault" is of less practical importance than what he said about the newer problems that now confront manufacturers and the means to be taken to meet them, tho it is the former that is being so much quoted and discussed.

Automatic Milling Machine for Rounding the Ends of Gear Teeth.*

MARCEL LEJEUNE SYSTEM.

Gear manufacture and cutting is an industry in which several Parisian concerns are distinguished. Marcel Lejeune is well known as a specialist in manufacture and a meritorious inventor. His last creation relates to a machine for rapidly and with mathematical exactitude rounding off the ends of gear teeth. This curve, intended to facilitate the lateral throwing into mesh of two spur gears, may be given any form or may consist simply of a sort of bevel.

It needs to be made on one side only. Moreover, the consecutive flank forming part of the same outline remains full. In this way the tooth which is to enter the curve comes first against the cut-away corner, which facilitates its entry, and then bears against the remaining full part. This obviates its tendency to be thrown out as in the case of rounded teeth.

In this machine the gear to be cut has only a simple rotary motion, the movement of translation being given to the cutter.

From the combination of these two movements results the desired curved form, and the number of teeth is obtained by means of a train of gearing.

The accompanying figures represent the new machine of M. Lejeune. The spindle *a* on which is fixed the gear to be cut, *b* (Fig. 1) carries a gear *c* (Figs. 1 and 2) driven by a small gear *d* on the axis of which is keyed a change gear *e*, with the necessary number of teeth to obtain the desired result.

The gear *e* is driven by another, *f*, keyed on a shaft *g* which carries fixed gears *h*, *i*, *k*, enclosed in a casing *l* (Fig. 5).

Any one of these gears may be driven by the gears *h'*, *i'*, *k'*, carried on a clutch *m*, which can slide on a driving shaft *u*. On this shaft is fixed the bevel gear *o* and a worm gear *p*, driven by a worm *q*, actuated by a suitable belt *r*, *s*.

The cutter *t* is given a rotary movement by a belt *u* and pulleys *v* having an adjustable support *w*. It is evident that this support is fixed on a sliding carriage *x*, taking a reciprocating horizontal motion from a lever *y* which bears against a cam *z*. This cam is turned by means of the vertical shaft *b'*, by the action of a bevel gear *a'* meshing with the aforesaid gear *o* (Figs. 2 and 3).

The movement of the lever *y* is regulated by a guide *c'*, to which it is fastened at d^1 and the position of which is determined by a screw *e'*.

A tension spring *f'* is fastened between the frame *g'* and tool carriage *x*.

In order to be adapted to the different diameters of gears that are to be cut, the upper part of the machine may be raised or lowered in relation to the shaft *a* by means of a shaft *l'* on which is fixed a gear *m'* meshing with a rack *n'* attached to the fixed frame *o'* (Fig. 2).

Fig. 2 shows the lever *y* arranged for making the cutter work from right to left, but if it were desired to machine the opposite side of the gear *b*—*i. e.*, to work from left to right—it would be necessary to fasten this lever at d^2, its point of oscillation would be changed from p' to p^2 and the spring *f* would be fixed at *g'* to the movable frame *g'*, the motion thus being reversed.

With this machine thirty wheels of different diameters suffice for the machining of gears with 10 to 118 teeth.

*Translated from the *Revue Industrielle* by E. P. Buffet.

Civic Federation's Project for World's Fair Visitors.

The welfare department of the National Civic Federation has established a World's Fair bureau in the Transportation Building at the World's Fair grounds, St. Louis, and H. H. Vreeland, president of the department, has sent letters to 10,000 employers of labor offering services of the bureau to any employees who might feel inclined to visit the fair. In this letter Mr. Vreeland explains that the bureau will be glad to arrange free of all charge for economical accommodations thru responsible agencies, to prepare and furnish itineraries for the systematic observation and study of objects of special interest in the various departments, and otherwise to do everything possible to contribute to the profitable enjoyment of those who visit the exposition under its auspices.

Mr. Vreeland says that one of the Illinois members of the Federation has sent 6,000 employees to the fair, and that an Ohio member has arranged for 2,500 to go, while many smaller groups have been announced. In most cases the employer has helped either by bearing some of the expense or by securing reduced railroad transportation.

The following, from a miller's paper, strikes us as a good advertisement for a fellow looking for a job:

Wanted—All who read this to know I am not advertising just to see my name in print, but because I want a permanent position as head miller. In altogether too short a time I have lost my position twice, once by change of proprietors and once by flood, but never through incompetency, carelessness or immorality. I have the best of recommendations from last and former employers.

AMERICAN MACHINIST

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The Practical Man vs. the Technical Graduate

Elsewhere in this issue a correspondent signing himself "Dixie" shows us how ignorant of some things a certain graduate mechanical engineer was, and we let him have his say, tho, as a matter of fact, such things prove very little. We have known men who had served an apprenticeship and were supposed to be skilled workmen, yet who were just as painfully ignorant of many things they ought to know, as was Mr. Robb. A man who has had the opportunity to do so and yet does not know the difference between a cam and a pawl, simply has no taste for or natural capacity to learn mechanical things and will never be successful in that line, whether he graduates from the shop or from a technical school. The man who does succeed in mechanical pursuits hungers for information; he finds out things about machinery because he likes to do so and is impelled from within. He will gather information from any source whatever, and will make use of it. And usually when a man has this natural inclination for mechanics he will be the better off for a thorough technical education. He will by that learn a lot of things easily that otherwise he will have to work very hard for or go without the knowledge of, and if a man is of the right sort, his technical education will not prevent him from acquiring all the practical knowledge he needs to have. While technical education sometimes is charged with preventing men from acquiring practical knowledge, it is pretty certain that it does not necessarily do so. We think the only sure way to judge of the capabilities of a man is to investigate the man and his work and to pay very little attention to just how he got the knowledge enabling him to do the work. Good work is good work, whether done by a graduate of a school or of a shop, and a man who has little or no faculty for mechanical matters and little natural liking for them will usually make a pretty poor showing in a mechanical pursuit, no matter whether he has been to school or not.

The natural tendency seems to be for the shop man to belittle technical education and to say that the shop is the only place to learn things worth while. On the other hand, the "grad" is too often inclined to view with contempt any knowledge whatever not gained in a school or by strictly school methods. All this is only a form of selfish pride or excessive self-appreciation. The less it is indulged in the better for all concerned.

The writer knows of a case in which a manufacturing firm wanted a man to do certain work and were convinced that only a technical graduate could do it. They ended by offering a non-graduate a much higher salary than they had at first thought of paying, simply because they had the good sense to perceive that in him they had found a superior man of proven ability to do the required work in a superior manner. The establishments in which there is a prejudice either for or against graduates are pursuing a mistaken course. In choosing a man the question should be, "What can he do?" or "What has he done?"

If a man does the best he can according to his opportunities, he may, we think, leave the question of whether or not the "practical man" is to be driven out by the technical graduate to settle itself. It will probably be settled right in the end.

Alleged "Property" Safety Devices for Steamboats.

It is being charged that there are such things as "property" furnishings which are transferred from one boat to another in New York harbor and that these "property" belongings are placed on board a vessel about to be inspected and taken off immediately after the inspection is passed. We hope such a thing is not true, but if it is then no penalty can be too severe to be inflicted upon men who thus trifle with lives intrusted to their care.

On behalf of the inspectors it is claimed that they have no means of preventing nor authority to prevent this fraudulent passing of inspection, tho it is obvious that a sure prevention of it would be to abandon the present idiotic practise of inspecting steam vessels only when asked to do so by their owners and to inspect them at any time without notice to the owners. That is the way it should be done and no other way should be thought of.

Standard Hose Couplings.

As our readers are aware, we have had a good deal to say lately on this subject and have hoped that ultimately a single standard for fire hose and hydrant couplings might be established throughout the country.

In an interesting article on the topic in *Engineering News*, C. E. Loetzer states some of the reasons why such a vast number of coupling sizes have been adopted and retained in various parts of the country and deals with the difficulties surrounding efforts to reduce these to a common standard.

Regarding the labors of the International Association of Fire Engineers along this line, Mr. Loetzer says:

"As far back as 1879 the International Association of Fire Engineers, at its seventh annual convention, adopted the 'National' hose coupling size and thread, which is 3 7-32 inches outside diameter of male thread and 6 threads per inch, the universal installation of which that body desired and recommended. Since that action was taken twenty-five long years have come and gone, and we are justified in making the query, has the 'National' size been universally adopted? If not, why not? If there is even a single instance on record where a city or town in all those years actually changed from some other

to the 'National' size, such case is not known to the writer, and of the many towns and villages that have since installed fire hydrants and apparatus but very few have adopted that size. If the International Association of Fire Engineers, the highest fire tribunal, an organization made up of the best and most competent fire chiefs, men who are most directly interested and are in full charge of and in closest touch with this matter, if this body, made up of such men, have in all this time been able to accomplish so little, practically nothing toward the adoption of a uniform size, it would seem conclusive evidence that such change is exceedingly difficult, if not impossible, to bring about."

Then in dealing with the trouble and confusion which might be created for a time in bringing all places to the same standard he says: "It must be borne in mind that the making of this change means the removal of the couplings from hose and the placing of new ones, taking out the discharge nozzles from hydrants and inserting new ones, changing threads on engines, etc. It further means that during the process of this change there would be some hose with old couplings and some with new, some hydrants with old nozzles and some with new, some engines with old and some with new threads, and some hydrants and hose without either couplings or nozzles. Imagine, if you can, the amount of confusion this would produce and how seriously handicapped the departments would be under these conditions in case of fires, especially large ones."

As a means of approach to a standard, however, that is by doing away with innumerable odd sizes which have crept in thru lack of proper gages, crude methods of early manufacturers, working to old couplings as gages, etc., he suggests the adoption of the system given below, which certainly would go far toward the elimination of hose coupling troubles:

"A careful study of the appended system of hose-thread sizers will show how this can be accomplished. This method has been originated by the writer, has been in use for some time, and is working with entire satisfaction. It reduces the evil to a minimum; standardizes the existing varying sizes, and eliminates the many fractional sizes between each two sizers without, in any manner, proving annoying to either maker or user.

"Work, especially hose couplings made according to this system and stamped with its sizer number, will always bear its record of identification, regardless of how old it may become or how badly worn or mutilated it may be. Its sizer number will always show its original and correct size and thread, and will prove a reliable guide for duplicate work in the future. As there is no copyright, patent or string to this whatever, the writer sincerely urges its adoption upon all manufacturers, for their own and the country's general good, and will be glad to furnish any assistance that may be desired in its installation.

Diameters of male thread and number of threads per in.

Sizer No.	Diam. ins.	Threads.
1	3	8
2	3 1-32	8
3	3 1-16	8
4	3 3-32	8
5	3⅛	8
6	3 5-32	8
7	3 3-16	8
8	3 1-16	6
9	3 3-32	6
10	3⅛	6
11	3 5-32	6
12	3 3-16	6
13	3 7-32	6
14	3¼	6
15	3	7
16	3 1-32	7
17	3 1-16	7
18	3 3-32	7
19	3⅛	7
20	3 5-32	7
21	3 3-16	7
22	3	7½
23	3 1-32	7½
24	3 1-16	7½
25	3 3-32	7½
26	3⅛	7½
27	3 5-32	7½
28	3 3-16	7½
29	3¼	5

LOETZER'S SYSTEM OF FIRE HOSE THREAD SIZERS.

"The above numbers refer to male sizer and threads. Make all male threads the exact diameters of sizer and female threads to contain the play. Stamp sizer number on both parts. For slight variations from above sizes, make male threads to next smaller sizer, and female threads to next larger sizer. A play of 1-64 to 1-32 inch between male and female threads must be allowed in all cases. Angle between threads, 70 degrees. Sizes not within above range should be designated as 'special' and marked 'S.'"

While the above system would if generally adopted be of benefit in taking out of the hose-coupling question a vast number of odd sizes, we cannot help criticising the 70-degree thread angle. There are undoubtedly a good many coupling threads which are as near a 70-degree angle as they are an angle of 60 degrees. Probably there are many that are less than 60 degrees. With a play of 1-64 to 1-32 inch in all cases between male and female it would seem that a new coupling member with a 60-degree thread would still assemble with an old one of a slightly different thread angle, thus making it possible, as old couplings wear out, to eventually bring all coupling threads to the common angle of 60 degrees.

It is difficult to see how the threatened anthracite coal strike can have any possible justification. The decision of the strike commission specified a method of interpreting it in case of disagreement, and if that fails the interpretation can be by arbitration, and it will be, unless one, or both, sides want to have trouble.

Technical Publications.

"Train Rules and Train Dispatching." By H. A. Dalby. 217 4x6-inch pages. Illustrated. The Derry-Collard Company, New York. Price, $1.50.

The object of this book is well given in its secondary title, "a practical guide for train dispatchers, enginemen, trainmen and all who have to do with the movement of trains." Written by a train dispatcher, it gives without a superfluous word the practise of train movement. It concludes with the standard code of the American Railway Association, including standard forms of blanks and diagrams of hand and train signals. The usefulness of the book to every railroad man is manifest on every page and, like the other publications of the company, it is sent to any address on approval and subject to return if not satisfactory. We predict that few copies will be sent back.

"An Engineering Student's Notes, Technical, Philosophical and Otherwise." By J. Richards. Industrial Publishing Company, San Francisco, Cal. 200 5x7½-inch pages. Cloth. $1.00 by mail.

Those who know something of the work of the veteran engineer John Richards will especially enjoy this book, and few people, whether engineers or not, will find it uninteresting. The author possesses the ability to do original thinking on many subjects besides mechanical engineering, and, as many of our readers well know, he has the faculty of presenting his thoughts in a very interesting manner. Few books of its size touch upon so many subjects, each is treated briefly and they cover a range of territory extending from San Francisco to Stockholm. In the same chapter we find ideas on slavery and flywheel boring, on grindstone frames and salt cellars. The author explains in the preface that the subject matter of most of the book was written between the years 1890 and 1897 and published in the magazine *Industry*, of which he was editor. Many readers will be glad to find it in this permanent form.

"Boiler Construction." By Frank B. Kleinhans. 421 5½x8-inch pages, with 334 text cuts and 5 folded plates. The Derry-Collard Company, New York; The Locomotive Publishing Company, London. Price, $3.00.

On no technical subject are books more prolific than on boilers, but we recall none which fill the same field as the one under notice. Most of the books on this subject are for engineers' or designers' use, while this one is for the shop man. The author, who will be recognized as one of our contributors, is obviously very much at home in a boiler shop and covers his subject very completely. The various chapters treat of laying out, flanging and

forging, punching, planing, bending, machining, riveting, stays and staybolts, assembling, calking and boiler-shop machinery. The illustrations are all drawn from locomotive boiler making, but are of course equally applicable to shell boilers of all kinds. The book concludes with five folded plates which give full working drawings of various forms of locomotive boilers. Like all of the publications of the publishers, this one is sent to any address on approval. It has no title on the back of the cover and no one can see what particular book it is or what it is about unless it lies flat upon a table right side up and with no other book piled on top of it.

Some New Things.

UNIVERSAL CUTTER GRINDER.

The illustrations show a universal grinder which possesses many novel features. Fig. 1 is a general view of the machine. The grinding head can be raised or lowered, swung around 180 degrees horizontally or 90 degrees vertically, without altering the tension or running of the belt. The machine is supplied with automatic feed or hand feed, as desired. In the "V" centers, seen on the floor and also in position on the machine (Fig. 1) may be clamped the various attachments, etc., which go with the machine, or long reamers, etc., may be fastened direct in the "V" itself. By means of a nut in the T-slot of the table, and a bolt passing thru a diagonal hole in the base of the "V" center, the centers are drawn up against one side of the T-slot in the table, thus tending to preserve alinement. These "V" centers are adaptable to a graduated base when it is necessary to throw the work round at an angle. The tooth rest is held on the top of the head in a horizontal plane, so that the head may be swung without changing the vertical adjustment (shown fully in Fig. 3). The clearance

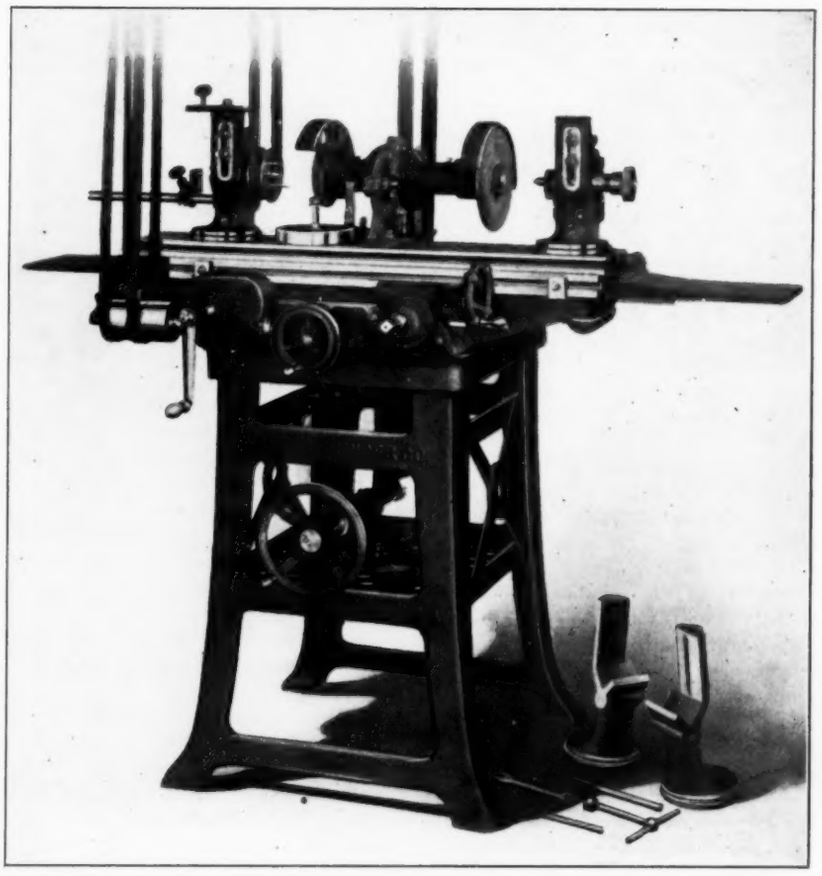


FIG. 1. UNIVERSAL CUTTER GRINDER.

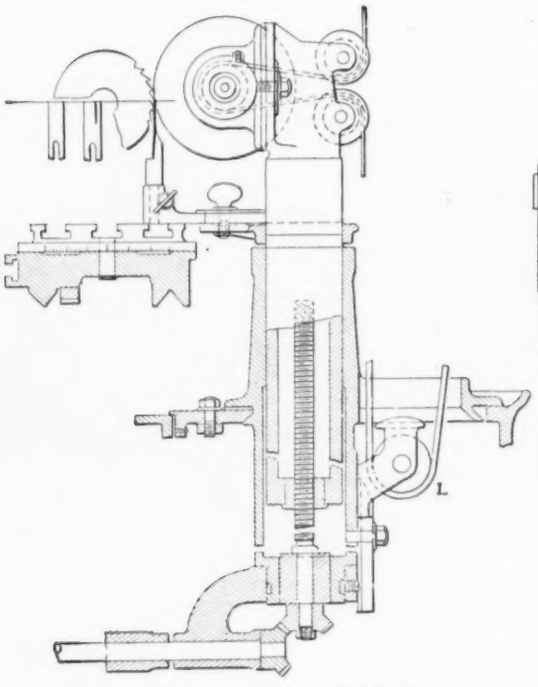


FIG. 2 Section through Column and Table

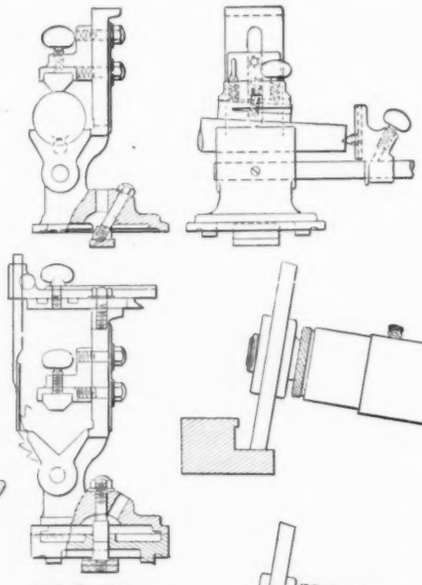


FIG. 3 V Center

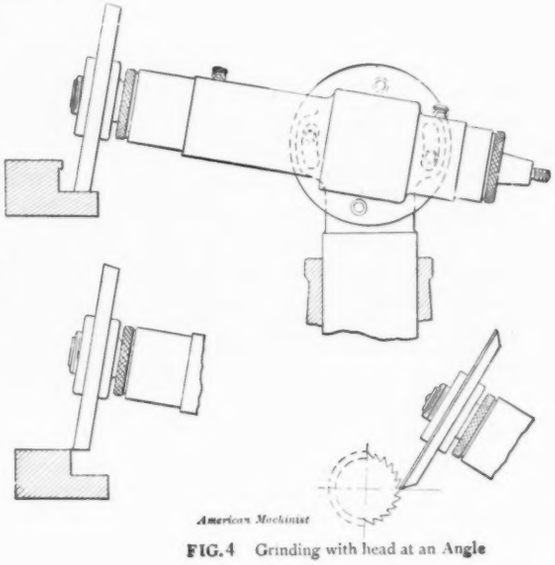


FIG. 4 Grinding with head at an Angle

is obtained by tilting the grinding spindle.

Fig. 2 shows the machine in section, and requires no comment, except that *L* is a weighted take-up for the belt. Fig. 4 shows the spindle tilted at an angle, and Fig. 5 shows vertical spindle grinding with a cup wheel; it will be seen that a sleeve has been inserted between the grinding head and the column so as to obtain sufficient overhang.

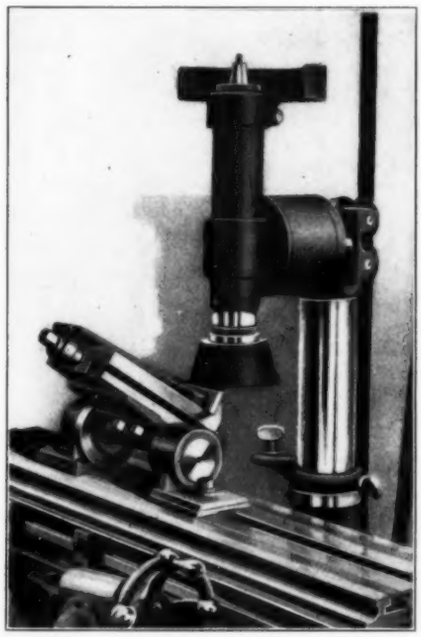


FIG. 5. GRINDING WITH HEAD VERTICAL.

Fig. 6 shows internal grinding, the small grinding spindle being thrown up out of the way while the operator tests the work. It will be seen from the illustrations shown that an almost endless variety of grinding can be done on this machine. The machine is supplied with a variable speed countershaft, which has an indicator. All the operator has to do is to measure the diameter of the wheel he is using and run the pointer of the indicator over to the number corresponding. This gives the correct spindle speed. The machine shown has a capacity of 25 inches between centers, swings with two sets of heads, either 9 or 14 inches, and has a vertical adjustment of 10 inches. It is built by O. S. Walker & Co., Worcester, Mass.

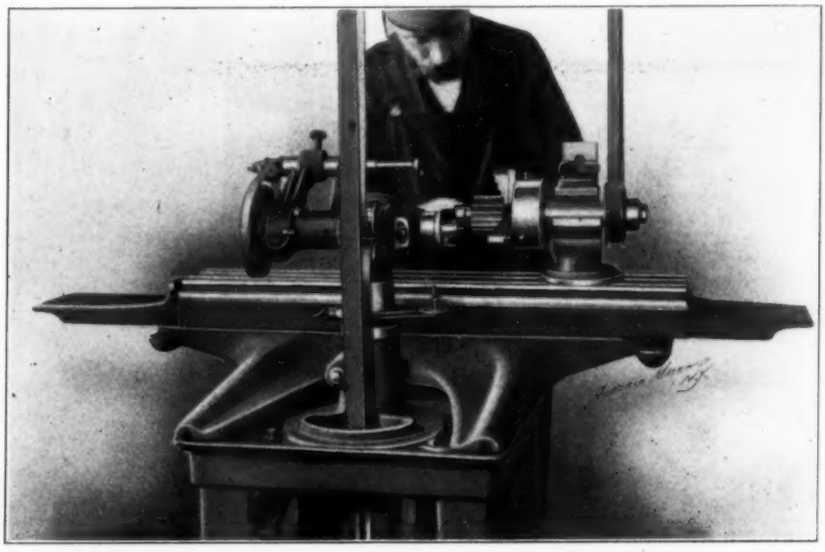
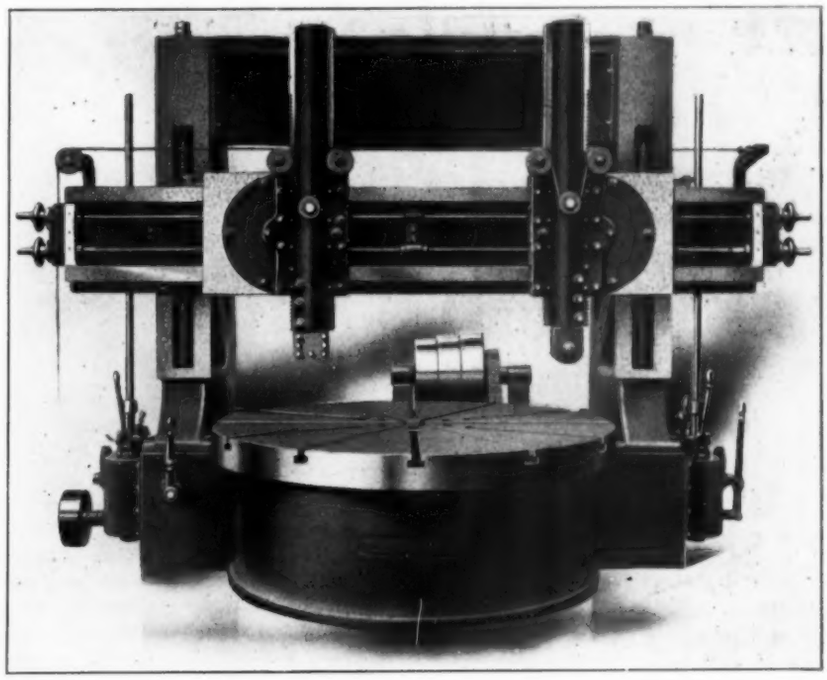


FIG. 6. INTERNAL GRINDING.

A BORING MILL.

The illustration shows the general design of 6- and 7-foot vertical boring and turning mills. The bed is one piece, with uprights bolted to it. On each side is a gear box containing eight rates of power feed for the tool bars and crossheads; each gear box has a change-gear attachment, so that any thread can be cut by either head. The standard threads that can be cut with 48-tooth change gear are 64, 32, 16, 12, 8, 4, 2 and 1½ per inch.

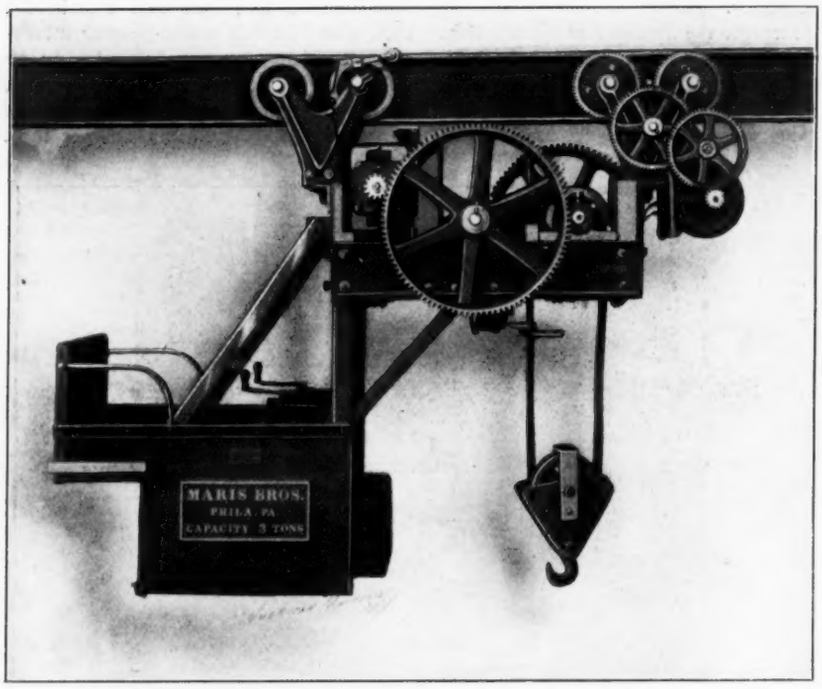


A BORING MILL.

Either head can be brought to the center for boring, and can be set at any angle up to 45 degrees in either direction. The feeds, as well as the power travel of the tool-bars and crossheads with which these mills are provided, are stopped, started or reversed by the hand-wheels shown at either end of the crossrail. Each hand-wheel controls a taper friction located between two gears running in opposite directions on the ends of screws and shafts. The gears on ends of crossrail, as well as the bevel gears on the back of the rail, and the change gears on feed boxes, are all enclosed with gear covers, protecting the parts from dirt and accident and the operator from injury.

The cone pulley for belt-driven mill or motor for electric drive is located on the bed between the uprights, so that direct connection can be made with the back gears within the bed, by means of Morse silent chain. The mill has four rates of friction back gear, from 12 to 187½, controlled by two levers at the right of mill. The cone steps are 21, 19¼ and 17½ inches diameter for 5-inch belt, and the twenty-four table speeds, from 9-10 to 30 revolutions, with which the mill is provided, are in geometrical progression.

We received a photograph (not shown) of gray-iron chips, ⅛ inch feed, ¾ inch depth of cut, made on these machines at 52 feet cutting speed. These machines are built by the J. Morton Poole Company, Wilmington, Del.



THREE-TON ELECTRIC TRAVELING HOIST.

THREE-TON ELECTRIC TRAVELING HOIST.

The illustration shows an electric traveling hoist designed to run on the lower flange of an I-beam. It has a cage for the operator to sit in. The three-ton machine measures 8 feet 4 inches long by 2 feet 7 inches wide; distance from bottom of track to bottom of cage, 5 feet 1¼ inches; bottom of track to hook at its highest point, 3 feet 5 inches. The trucks are built rigid for straight track or swiveling for curved track.

Where these hoists have to cross switches an additional set of electric contacts is provided so as to avoid any dead point in running from one wire to another. The hoisting is by wire rope in connection with spur gearing. There is an automatic safety throw-out to prevent over-running. This cut-out is thrown when the block reaches a certain hight, the current is reversed by it and the load may be lowered but cannot be hoisted, until the switch is set again by the operator. The working of this cut-out is not affected by either stretch or shortening of the rope, as it is thrown by the block itself.

These machines are made in various styles and sizes to operate from cage or floor by Maris Brothers, Fifty-sixth and Gray's avenue, Philadelphia, Pa.

UNIVERSAL MILLING MACHINE.

The illustrations show a No. 2 universal milling machine built by the Owen Machine Tool Company, Springfield, Ohio. This machine has geared power feeds with automatic stops, in all directions. It will be seen by referring to Fig. 2 that on the end of the spindle *A* is mounted a sprocket wheel which is connected by a chain with a sprocket wheel upon the short shaft *B* which carries at its other end a gear. At the back of shaft *B* is mounted a back gear which engages with the gear on the shaft *B* and transmits motion to the gear *C* loosely mounted upon the shaft *D*. The clutch *E* which is splined to the shaft *D* can be thrown into engagement either with gear on shaft *B* when the shaft *D* will rotate at the same speed as the shaft *B*, or the clutch can be thrown into engagement with the gear *C*, which will give the shaft *D* a different speed, which speed is determined by the back gears before referred to. At the other end of the shaft *D* are two loosely mounted gears *F* and *G*, and a clutch *H* splined to the shaft *D*. By throwing the clutch into engagement with either of the gears *F* or *G* the motion of the shaft *D* is transmitted to the gears *L* or *K* thru the intermediate gears *J* and *I*. Between the gears *L* and *K* on the shaft *N* is situated a clutch *M* splined to the shaft *N*. The clutch can be thrown into engagement with either of the gears *L* or *K*, thus transmitting to the shaft *N* either a fast or slow motion. At the other end of the shaft *N* and loosely mounted upon it are two bevel pinions *O* and *P* engaging with the bevel gear *R* which is rigidly mounted on the shaft *S*. Between the bevel pinions *O* and *P* is a clutch *Q* splined to the shaft *N* by means of which the motion of shaft *S* is reversed. The shaft *S* is splined its entire length and upon it is mounted the

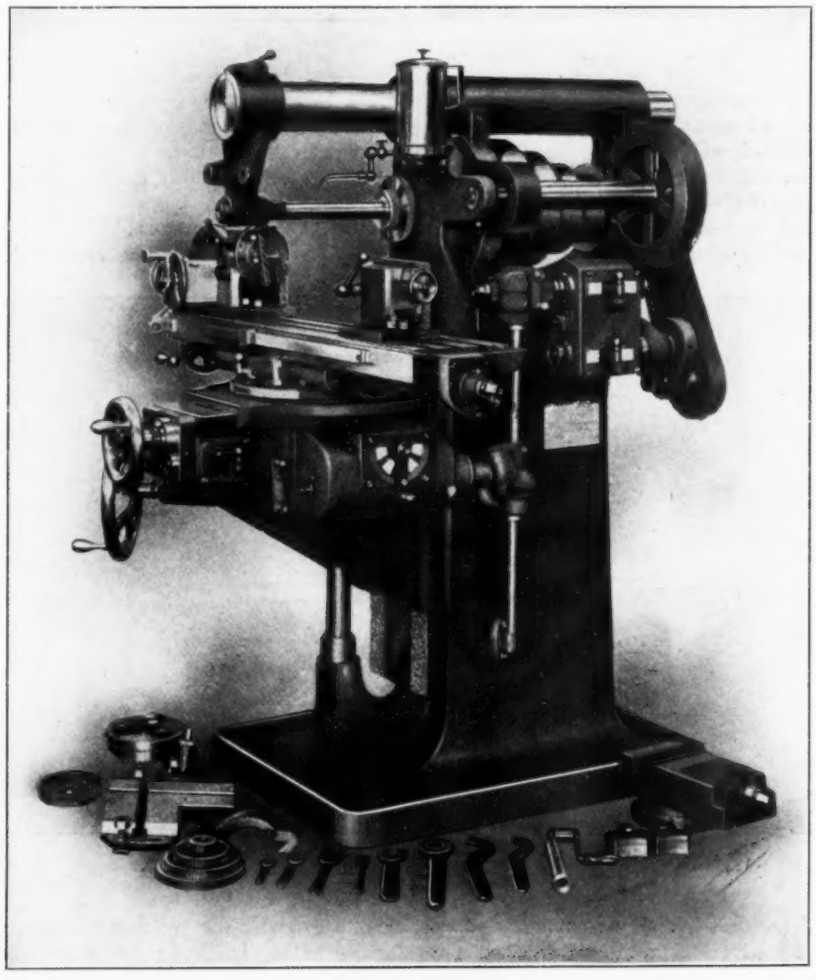
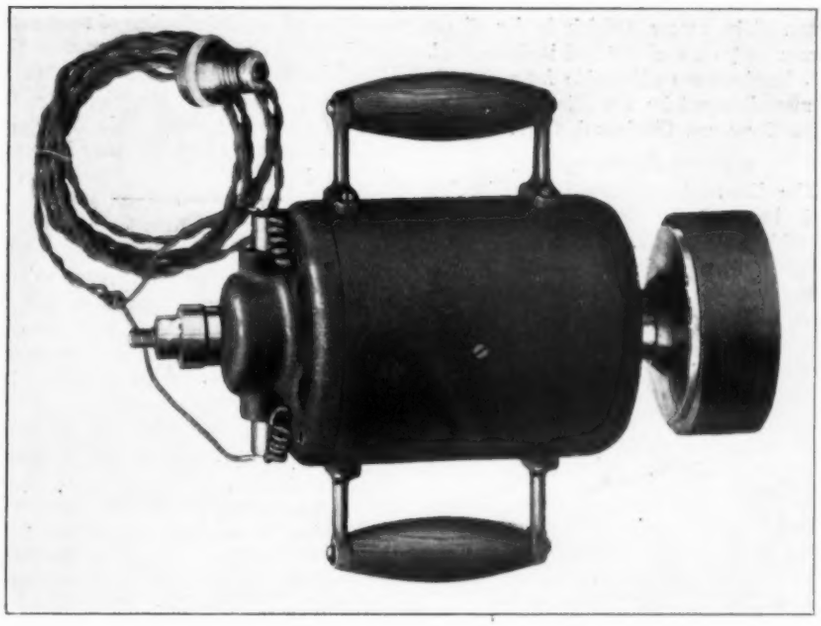


FIG. 1. UNIVERSAL MILLING MACHINE.

sliding miter gear *T*. This miter gear meshes with the miter gear *U* and thus drives shaft *V*. Upon this shaft are two spur gears *W* and *X*, and near the end of it are two more gears *Y* and *Z*. Between these two groups of gears is situated the clutch *e* which has teeth at two points upon its perifery and also at its ends. By moving it a short distance to the right or left the teeth upon the perifery engage with teeth formed on the inside of the spur gears *W* or *Y*; if it is moved further to the right or left, it disengages with *W* or *Y* and the teeth formed on its ends become engaged with the teeth formed on the ends of the gears *X* or *Z*, thus transmitting the motion of shaft *V* at different speeds to the shaft upon which are mounted the gears *a*, *b*, *c*, *d*. From the gear *a* there is the usual connection and gearing for moving the knee, the saddle or the platen. This arrangement of parts dispenses with all forms of universal joints and similar devices. The feeds are positive and plates indicate to the operator just the feeds obtained by the various positions of the levers, which cover a wide range. A single lever near the frame of the knee disengages any feed that may be in operation. The other features of the machine will be readily perceived from the engraving.



ELECTRICALLY DRIVEN HAND GRINDER.

ELECTRICALLY DRIVEN HAND GRINDER.

Everyone who has handled grinding work on rough castings, etc., knows what a loss of time, energy and money is often incurred in handling heavy castings which have to be ground. This grinder obviates a good deal of this costly handling. It is light in weight, can be carried anywhere as any length of flexible electric cord can be used. Power for it can be obtained from any incandescent lamp socket. It is under the control of the operator at all

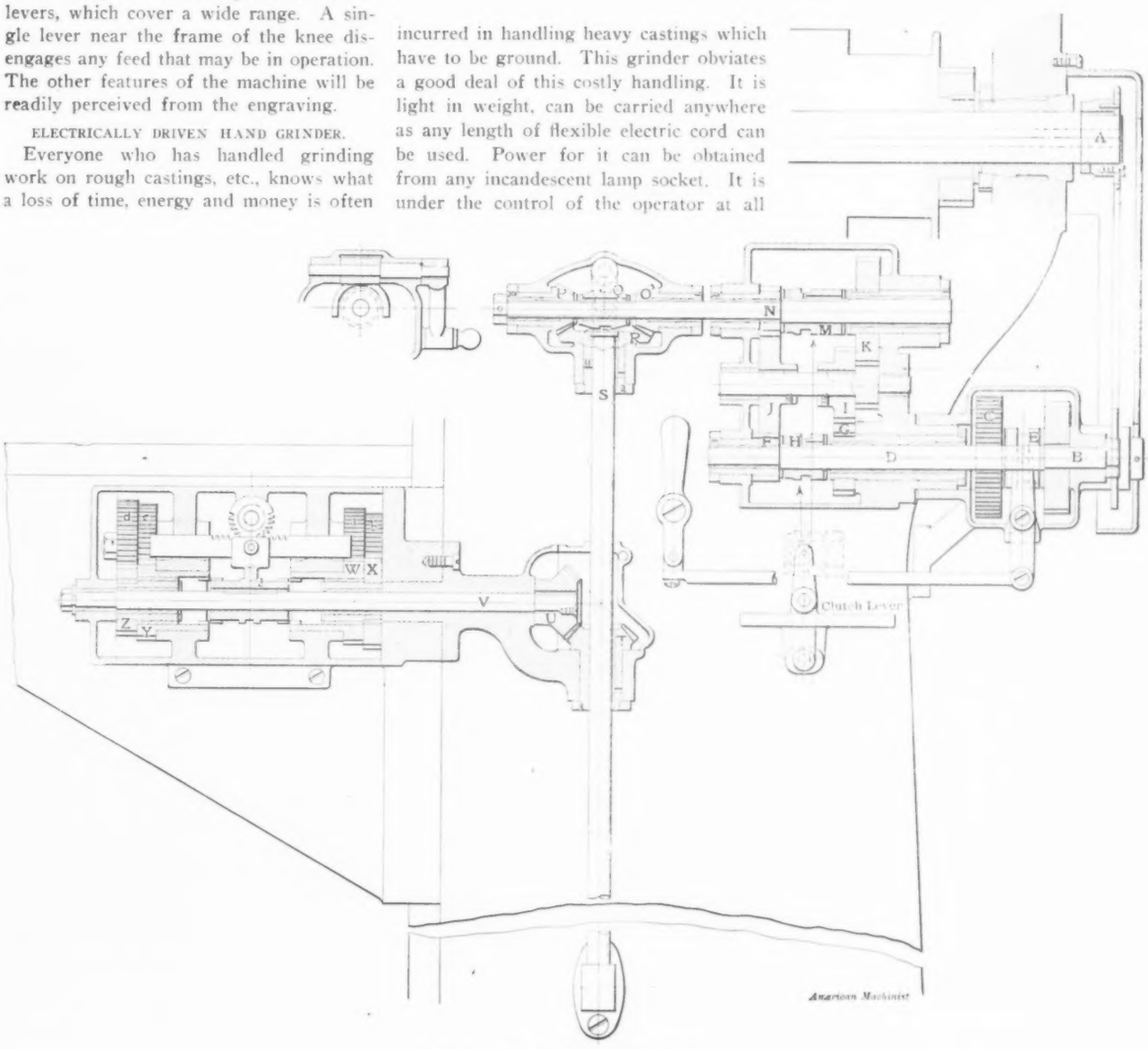
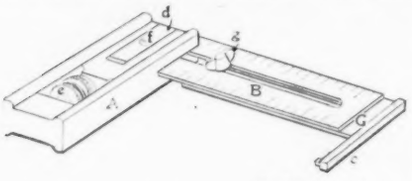


FIG. 2. FEED GEAR ARRANGEMENT.

times. The motor (which is for direct current only) is enclosed and is dust-proof. The bearings are adjustable for wear. It is manufactured by the Hisey-Wolf Machine Company, Cincinnati, Ohio.

MACHINIST'S TRY-SQUARE.

The illustration shows a combination tool invented by Anthony Duffy, of Poughkeepsie, N. Y. The various combinations consist of an adjustable square, center square caliper, hight gage and adjustable straight-edge. It will be seen that the stock *A* is slotted at one end to receive the slotted blade *B*. The stock *A* is also slotted at right angles to the slot



MACHINIST'S TRY-SQUARE.

for the blade and fitted to this second slot is the block *d* which has a threaded stem that reaches thru a hole which is drilled lengthwise in the stock and has at its end a nurled nut *e*. There is a screw *f* thru the block *d* and the slot in the blade. When the nut *e* is screwed up it draws the blade up against the slot. There is a member *G* which slides on the side of *B* and is locked in position by the nut *g*. At the end of *G* is a small detachable member *c* which is used as a caliper leg, the other leg being *A*. This piece by reversing its position can also be used as a hight gage. There is also a centering head which is not shown.

Professor Sweet on the Trade School.

On the evening of July 21 the Metal Trades Association of Syracuse, N. Y., listened to a paper on trade schools by Professor Sweet, who outlined his plans more fully than he has done before. His hope of seeing such schools started in the near future is not bright, and on this point he said:

"But how is the fanciful school I have been describing to be brought about? It will not be in my time, but I hope in some of yours. Such changes before they materialize have to be harped upon by some man for about twenty years, then if he gets someone to help pick the harp strings with him the idea will grow, and in this case slowly, because it not only requires a change in sentiment, but money.

"I can see no hope until the happy coincidence comes about of a good machine shop in the receivers' hands and the time when the glory of giving money to colleges, libraries and hospitals has grown stale, and a millionaire buys the shop, donates and endows it for the purpose."

The Treasury Department has directed that an allowance for drawback equal to the duties paid on the imported materials used, less the legal deduction of 1 per cent., may be made on the exportation of turbine wheels manufactured at the I. P. Morris Company's works at Philadelphia by the William Cramp & Sons' Ship & Engine Building Company with the use of imported shaft forgings.

"Open Market" Purchases by the Navy.

It seems likely that a somewhat stricter inforcement of the law with regard to purchases by the Navy Department will be inaugurated. In connection with the disposal of the accounts of the Portsmouth (N. H.) yard, in which items amounting to several hundred thousand dollars appeared for things purchased in the "open market, the Controller of the Treasury says:

"The purpose of advertising is to invite competition by notifying those who have the desired articles for sale of the terms and conditions upon which the government will purchase. Experience has taught us that purchases should be made in no other way, and the law so commands when time and circumstances admit of this method, but when this precaution is generally neglected by a department, fraud and scandal follow almost as a matter of course. It is expected that the ordinary rules relative to advertising, contracting for supplies and making payments therefor in the future will be followed by you and all other officers of the Navy."

Machinery and Other Business in Japan.

Chas. A. Francis, writing under date of July 3 from Tokyo, Japan, says:

"I was in Yokohama yesterday, and in talking with F. W. Horne, a dealer in American machinery and tools, he said that last year was closed the largest business in this line, as I told you and which you inserted in your paper. But he told me that tho last year was the largest the first six months' sales for this year are larger than the first nine months of last year.

"I have seen by some American papers that everything is at a standstill here in Japan on account of the war. Where they get their figures, I do not know; but in Tokyo I do not see any difference; they are building new electric railroads, and you would not know there was a war hardly. Of course there are a few things in which there is not so much business, but in the machine line there is more, and when the war is over there will be a very large increase in all kinds of manufacturing, everyone says."

The Campbell Printing Press & Manufacturing Company, Taunton, Mass., desire to hear from dealers in special tools and appliances that can be used to advantage in the manufacture of their printing presses and Autoplate machines.

The United States Steel Corporation has acquired the wire plant of the Trenton Iron Company. This business was founded in 1847, and the original incorporators were Peter Cooper, Abram S. Hewitt, Edward Cooper and James Hall.

It is reported that the General Electric Company has decided to install a wireless telegraph system between its Schenectady and Lynn plants. At present telegraphic communication between these plants is understood to call for some two or three hundred telegrams daily, while telephone charges amount to about $100 a day.

It seems that some steam users have been getting cheap water gage glasses and the matter is to be investigated. Scotch glasses have been sold here at a price lower than that at which the regular importers can bring them in after paying duty, and it is thought that they must be coming in under a wrong classification—*i. e.*, a classification under which the rate of import duty is lower than it has been.

Personal.

Wm. H. Armstrong, formerly manager of the New York business for the Chicago Pneumatic Tool Company, is now associated with the Ingersoll-Sergeant Drill Company, of 26 Cortlandt street, New York, and will look after the interests of the pneumatic tool department.

George K. Willand, secretary of the Washburn Shops of the Worcester Polytechnic Institute, has sent in his resignation to the Board of Trustees to take effect August 1. Mr. Willand has been identified with the institute for the past ten years and is to enter the manufacturing business in Worcester.

Obituary.

John Rogers, the sculptor, whose groups of statuary known as the Rogers Groups were for many years about the only specimens of genuine art that were widely distributed in American homes, died July 26 at his home in New Canaan, Conn. Mr. Rogers was first a dry-goods clerk in Boston, but afterward learned the machinist's trade. He, however, showed a strong artistic talent from the first, and one day seeing a man modeling in clay, he tried it, liked it and soon produced his first work, "Checkers at the Farm." Mr. Rogers was born in Salem, Mass., in 1829, but spent many years of his life in New York city.

Charles Frederick Spang, founder of the firm of Spang, Chalfont & Co., Pittsburg, died at his home in France, July 20, ninety-five years old. He was born in Pennsylvania, his father being an iron manufacturer. He was the pioneer tube manufacturer west of the Alleghenies.

George Fordyce Blake, inventor of the Blake steam pump, died July 22, eighty-five years old. Mr. Blake in 1861 invented a clay pulverizer and the steam pump, patented in 1864, was designed as an auxiliary to that. The pump was perfected by numerous subsequent patents, and in 1874 the Geo. F. Blake Manufacturing Company was formed.

Business Items.

The firm of Henry R. Worthington has published a small map showing the location of its old works in South Brooklyn, the offices in Manhattan and the new works at Harrison, N. J., with the inter-communicating lines of transportation. The old works were founded in 1840, and now cover about 4½ acres and employ 2,000 men. The new plant occupies a 34-acre tract, has 18 acres of floor space and will accommodate 6,000 workmen. It is said to be the largest industrial plant near New York, and embraces the latest improvements in production engineering.

The Standard Brazing Company, of Boston, has licensed the Erie Car Works, of Erie, Pa., and the Portland Company, of Portland, Me., to do brazing of cast iron for the general trade.

Manufacturers.

The Consumers' Gas Company, Toronto, Ont., is to build an additional plant.

The Williamsport (Pa.) Staple Company has taken out a permit for an addition.

A molding and planing mill of Shaw & Remby, Medford, Mass., has been burned.

The bandsaw and planing mills of Kimball & Clark, Kimball, Wis., have been burned.

The Ludlow-Saylor Wire Company, St. Louis, Mo., proposes to enlarge its factory.

It is stated at Findlay, O., that Dr. W. B. Georgia will establish a lens-grinding plant.

Jarvis & Bros. Company's machine shop, Huntington, W. Va., has been destroyed by fire.

Extensive improvements are being made by the Garlock Packing Company, Hamilton, Ont.

The Singer Sewing Machine Company has begun to build a large plant at St. Johns, Quebec.

The Brown Corliss Engine Company, Corliss, Wis., is asking for bids on a factory building.

At the Wyoming Valley Lace Mills, Wilkesbarre, Pa., extensive improvements are contemplated.

It is stated at St. Cloud, Minn., that plans for a packing house of Kost & Lammersen are completed.

J. Rosenbaum Grain Company, Chicago and Kansas City, will erect a large grain elevator in the latter district.

The Addressograph Company, Chicago, Ill., has purchased ground for an eight-story building, 89x125 feet.

A plant of H. Julius Smith, manufacturer of electric fuses, etc., Pompton Lakes, N. J., has been damaged by fire.

Fire in the lamp alament department of the General Electric Company, at Lynn, Mass., has caused some damage.

A three-story and basement machine shop, 44x200 feet, is being estimated on for the Auto Car Company, Ardmore, Pa.

Improvements are about to be made to the factory of S. Bowen's Son, paint manufacturer, North Penn Junction, Philadelphia.

August Goertz & Co., Newark, N. J., manufacturers of purse and satchel frames, propose to erect a four-story factory building.

Fire starting in the paint shop of the Michigan Central's car works, West Detroit, Mich., has considerably damaged the plant.

The sash and door plant of the South Side Manufacturing Company, Chippewa Falls, Wis., has been burned. It will be rebuilt at once.

The Havana (Ill.) Metal Wheel Company will erect a factory building, 300x60 feet, also an annex, 75x50 feet, for the power plant.

The Woerner Preserving & Packing Company, of Syracuse, N. Y., has under consideration the establishment of a factory in Tennessee.

The Colonial File Company, Boston, Mass., has had plans filed for a building, 140x30 feet, to be erected on Tenean street, Dorchester.

The contract has been let for a $58,000 five-story addition to the plant of the Bruening Cork Company, of Pittsburg, at Oakdale, Pa.

The Continental Sugar Company has executed a mortgage in the sum of $250,000 to provide for additions to the plant in Fremont, O.

The H. H. Franklin Manufacturing Company, Syracuse, N. Y., manufacturer of automobiles, etc., will build a 66x160-foot, five-story addition.

A large plant is to be built at the northwest corner of Elm and Commerce streets, Cincinnati, O., for the W. F. Robertson Steel & Iron Company.

The contract has been awarded for the erection of a large addition to a plant of the Olds gasoline engine manufacturing interests at Lansing, Mich.

New Catalogs.

The Scranton & Co., New Haven, Conn. Scranton power hammers. Illustrated. Circular No. 37. 6x9, pp. 16, paper.

Northern Electrical Manufacturing Company, Madison, Wis. "Northern Motors in Blowing and Ventilating Service," leaflet No. 131. The illustrations show motor-driven motors and fans; paper.

Thos. H. Dallett Co., Philadelphia, Pa. Catalog illustrating and describing in detail Dallett portable drilling machines and boiler shell drills, hand, belt and electrically driven. 6x9, pp. 44, paper.

The Garvin Machine Company, Spring & Varick streets, New York. Illustrated pocket catalog of agency machinery carried in stock by this company, including well-known makes of drill presses, lathes, planers, shapers, punch presses and shears, grinding and polishing machinery, etc. 4x6¼, pp. 274, paper.

Crocker-Wheeler Company, Ampere, N. J. Bulletin No. 47, illustrating the electrical equipment, supplied by the Crocker-Wheeler Company, of the plant which supplies power for the Intramural Railway, which operates on the exposition grounds, St. Louis. This power plant is located in Machinery Hall. The bulletin contains a map, in colors, of the grounds of the Louisiana Purchase Exposition.

Miscellaneous Wants.

Advertisements will be inserted under this head at 25 cents a line each insertion. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

Caliper cat. free. E. G. Smith, Columbia, Pa.

Punches & dies. Wal.M.Wks., Waltham, Mass.

Wire and sheet metal working machinery and tools. Emmons Collins, Chicago.

Will buy or pay royalty for good patented machine or tool. Box 282, AMER. MACH.

Light mach'y to order; model work; rubber molds. J. W. Weir, Bridgeport, Conn.

Wanted—Copy April 11, 1901, issue A. M.; state price. Box 195, AMER. MACHINIST.

Light and fine mach'y to order; mdoels and elec. work specialty. E. O. Chase, Newark, N. J.

Working drawings, tracings. Geo. M. Mayer, M. E., 1131 Monadnock, Chicago, Ill.

Automatic machinery designed and constructed by the Wellman Sole Cutting Machine Co., Medford, Mass.

Wanted—Second-hand vertical boring mill, 60 or 72 in.; must be in good condition. Ft. Scott Mfg. Co., Ft. Scott, Kan.

Auto. machinery of all kinds designed and built; hardened and ground work, flat or circular. Wiebking, Hardinge & Co., Chicago.

Will purchase, or manufacture on royalty, patented machine of merit. Address, with full particulars, Box 176, AMER. MACHINIST.

A director of methods for increasing machine shop output solicits engagements; vast experience; excellent record. Box 196, A. M.

Addressing machines without type; high speed; run by motor or foot power; write for the picture book. B. F. Joline & Co., 123 Liberty st., New York.

Wanted—Machines to build or repair, or other articles in machinist line to manufacture. A. Johnson, 18 Dunham Place, near Broadway Ferry, Brooklyn, N. Y.

Wanted—By fully equipped and modern machine shop, special machinery or machine parts to build by contract or day work. Address Ingle Machine Co., Rochester, N. Y.

Machinery manufacturing company in Switzerland would like to take up some further specialty, preferably in the textile or tool line; are willing to install special machinery. Box 200, AMERICAN MACHINIST.

For Sale.

Canada.—Double-blade hacksaw; cuts in half time; Canadian patent for sale; particulars. F. B. Wright, 177 Broadway, New York.

For Sale—One Sellers 8 ft. gap steam riveter, for 1 in. rivets; good as new; can be seen and tested at our works. Chambersburg Engineering Company, Chambersburg, Pa.

For Sale—1 Farrell Foundry hydraulic pump and press; 800 tons; cost $1,950; will sell very reasonable; perfect condition. H. M. Crowell Mfg. Co., 6th ave. and 13th st., Newark, N. J.

For Sale—Foundry and machine shop; good line of patterns for jobbing work, also patterns and equipment for building the most successful, up-to-date gas and gasoline engine on the market; town of 6,000; two railroads; two navigable rivers; no other foundry within 25 miles; stock, tools and real estate invoice about $7,000; a great bargain. H. H. Mason, Mt. Carmel, Ill.

For Sale—Four Watts-Campbell Corliss engines, 24x56; 400 horse-power at 100 lbs. steam pressure; 70 revolutions per minute; flywheel—diameter 20 ft., face 46 in.; condition first class. One double Watts-Campbell Corliss engine, 18x42; 250 horse-power at same pressure; 91 revolutions per minute; flywheel—diameter 16 ft., face 32 in. One N. Y. Safety engine, 12x12; 75 horse-power at same pressure; 250 revolutions per minute; 2 belt wheels, 4½ ft.; diameter 17½ in. and 13 in. face. Will sell singly. Can be seen in New York city by addressing The United Electric Light & Power Company, 1170 Broadway, New York city.

Wants.

Situation and Help Advertisements only inserted under this head. Rate 25 cents a line for each insertion. About six words make a line. No advertisements under two lines accepted, and no advertisements abbreviated. The cash and copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded. Applicants may specify names to which their replies are not to be forwarded; but replies will not be returned. If not forwarded they will be destroyed without notice. Original letters of recommendation or other papers of value should not be enclosed to unknown correspondents. Only bona-fide situation want or help want advertisements inserted under this heading. Agency advertisements must be placed under Miscellaneous Wants.

Situations Wanted.

Classification indicates present address of advertiser, nothing else.

CANADA.

Traveler—Special machinery and machine tools—desires position in United States or for Canada; good connections. Address Drawer U, Sarnia, Ontario, Canada.

CONNECTICUT.

Wanted—Position as superintendent or general foreman by a thorough, practical mechanic with 12 years' experience; age 39; member of A. S. M. E. Box 116, AM. MACH.

Competent machine shop foreman desires change; 20 years' practical experience; thorough mechanic; reference as to character and ability; age 42. Box 170, AMER. MACHINIST.

ILLINOIS.

Superintendent or foreman; experience steam, gasoline engines and mining machin-

very. Address T. Kellar, 245 63d Place, Chicago, Ill.

Draftsman. A1 technical education, 3 years' shop and 1 year's drawing-room experience on small tools, jigs, etc., desires permanent position anywhere. Box 187, AM. M.

MICHIGAN.

Experienced foreman patternmaker, now employed, desires to change. Box 122, A. M.

NEW JERSEY.

General draftsman and mechanical engineer wants position. Box 208, AM. MACH.

General foreman; 12 years with leading machine tool concern; highest references. Box 197, AMERICAN MACHINIST.

Designer and draftsman, with 4 years' experience in engines and special machinery, desires position. Box 210, AMER. MACH.

NEW YORK.

Experienced mechanical draftsman and designer wants position. Box 201, AM. MACH.

Wanted—Position as general foreman or assistant superintendent, by a thorough, practical mechanic. Box 202, AMER. MACH.

Position wanted as foreman in brass manufacturing work: age 42 years; can speak four different languages. Box 193, AMER. MACH.

Young mechanical draftsman, 3 years' experience, desires position in engineer's office, or as draftsman. Box 198, AMER. MACHINIST.

Mechanical draftsman, with 4½ years' experience, also had shop practice, desires position; best of references. 43 Jackson st., Palmyra, N. Y.

Foundry superintendent or foreman wants position; experienced; engine or general jobbing; East preferred; references. Address Box 173, AMERICAN MACHINIST.

Advertiser, correspondent and catalog compiler wants position; thorough knowledge of mechanics; best references. Address "Spanish," care AMERICAN MACHINIST.

Situation wanted as general or assistant foreman, by a man of 20 years of experience, who has been foreman and has best of references. Box 199, AMERICAN MACHINIST.

Competent designer automatic machinery and draftsman, experienced in shop and drawing-room management, open for position: New York city preferred. Box 211, AM. MACH.

Mechanical engineer will be open for engagement in September as superintendent or master mechanic; technical education and large experience in the manufacture of small interchangeable machinery, sheet metal goods, etc. Address Box 190, AMER. MACHINIST.

PENNSYLVANIA.

Mechanical draftsman wisaes position as assistant draftsman. Box 188, AMER. MACH.

Position as chief draftsman or assistant superintendent, by mechanical engineer, experienced in rolling mill, special machinery, general work. Box 131, AMER. MACHINIST.

Position wanted as general manager, superintendent, assistant superintendent or foreman, by man who has held those positions; at present general manager of manufacturing company. Address Box 212, AMER. MACH.

A practical machinist, with technical education, at present engaged, desires change; 35 years of age; 15 years' experience; the past 8 years as manager, buyer and chief designer of manufacturing plant building engines, boilers, sawmill machinery, etc.; salary $2,500. Address E. H., care AM. MACH.

TENNESSEE.

Wanted—Position as mechanical draftsman; 8 years' experience in railroad, locomotive and car work; 2 years' experience in machine work and 1 year in smelter work. Address Box 191, AMERICAN MACHINIST.

Help Wanted.

Classification indicates present address of advertiser, nothing else.

CANADA.

Wanted—Seven first-class toolmakers; state experience, wages wanted and how soon you could report in Quebec. Ross Rifle Co., Quebec, Canada.

Wanted—First-class engineer and draftsman; mechanical graduate preferred; one with experience in water-wheel, pulp and sawmill work; state age and experience. Box 205, AMERICAN MACHINIST.

CONNECTICUT.

Wanted—Two first-class toolmakers for a special line of small, accurate work; a man well trained on watch factory die work preferred. Veeder Mfg. Co., Hartford, Conn.

Wanted—Working foreman in a toolroom employing 6 or 8 hands, by a company in Hartford, Conn., manufacturing electric switches; must be thoroughly familiar with small punch and die work of good class; state fully previous experience, also salary expected. Box 209, AMERICAN MACHINIST.

ILLINOIS.

Wanted—Superintendent to take charge of the manufacture of gas engines on a large scale for a company just commencing the manufacture of gas engines; must be thoroughly familiar with the details of manufacturing gas engines in every respect; must have thorough, practical experience on gas engines; of good character; good organizer; must have tact and ability to handle men to the very best advantage; technical education not absolutely necessary; need not be a designer; best of references must be furnished; to the right man a good position. Box 194, AMERICAN MACHINIST.

MICHIGAN.

Wanted—A competent man, familiar with erecting cranes and crane runways. Box 207, AMERICAN MACHINIST.

Wanted—A recent graduate as assistant in a technical school mechanical engineering laboratory and drawing room. Box 153, A. M.

Wanted—Experienced draftsman; must be a good mechanic, a reliable man and have had experience designing jigs and fixtures for manufacturing first-class machine work on the interchangeable plan by the latest modern practise; state age, experience, wages and references; plant pleasantly located in Middle States. Address Box 179, AM. MACH.

NEW JERSEY.

Wanted—General foreman for machine shop; must be reliable, energetic and of more than ordinary executive and mechanical ability; not over middle age; location near New York; situation permanent if satisfactory; manufacturing first-class machinery of medium weight; employing 100 machinists; state nationality, age, salary, experience, references, to insure attention. Address Box 204, AMERICAN MACHINIST.

Wanted—General foreman for a machine shop located in New Jersey, employing 100 men, constructing machinery of medium weight; must have experience in modern methods; able to hire and control men to the best advantage and to produce machinery of high grade at a minimum of cost; under 40 years of age preferred; only capable men need apply; to insure attention, state age, salary, experience and references. Address Box 203, AMERICAN MACHINIST.

NEW YORK.

Wanted—Hustling foreman for machine shop in large electrical factory in Canada, particularly on induction motors and direct-current work. Apply, giving references, experience and wages required, Box 189, A. M.

Wanted—A few first-class erectors on large vertical engines, a few A No. 1 boring mill and lathe hands for heavy work, also a competent man for laying-out table. Apply, with reference, to The Snow Steam Pump Works, Buffalo, N. Y.

A general superintendent is desired for a well-known, old, prosperous manufacturing company; investment of $5,000 is required in the company's bonds, which are A1; splendid opportunity; good draftsman also wanted; investment $1,000. Box 206, AMER. MACH.

Wanted—A first-class machinist and toolmaker to teach those subjects in a technical school, day and evening classes; one with experience as foreman of a toolroom preferred. Apply by letter, giving qualifications in full, to Instruction Committee, 36 Stuyvesant st., New York.

Wanted—Foreman for toolmaking department of large manufacturing concern in Rhode Island; must have experience, executive ability and force; to take charge of 40 toolmakers and direct making from drawings, special tools, jigs, fixtures and models for small, high-grade machinery. Address, stating qualifications, Howard D. Black, P. O. Box 267, New York.

Wanted—A young married man, of good presence, to act in the East as special representative of leading firm of machine tool builders; experience in selling machine tools and acquaintance with the trade desirable, but not essential; preference will be given one who has had both practical and technical training and some business experience; must have highest references as to character and reliability; a splendid opportunity for the proper man; in writing, state age and give full information about work done. Address Box 192, AMERICAN MACHINIST.

PENNSYLVANIA.

Toolmaker on gasoline engines and carburetors wanted. State experience and wages. Bradford Motor Works, Bradford, Pa.

Wanted—One or two thoroughly experienced, competent men to erect and test steam engines, both in the shop and on the road; state fully age, experience and wages expected. Address "Automatic," care AM. M.

The Monotype Company maintains a school to train young men to meet the constantly increasing demand for operators of its type casting and composing machine. These operators have done so well that it receives more applications for places than can be filled. In making selections these qualifications carry most weight: common sense, type foundry experience, printing office experience, automatic machinery experience. Full particulars will be furnished to inquirers who furnish the same information about themselves. The Lanston Monotype Machine Co., 1231 Callowhill st., Philadelphia, Pa.

WEST OF MISSISSIPPI.

Machinist for general repair shop; all kinds of work; permanent job; union shop; good hand wanted. Washington Machinery & Supply Co., Spokane, Wash.

Wanted—A competent foreman for a well-equipped machine shop in San Francisco; good salary and permanent position to the right man. Address, giving full particulars, "Hydraulics," care AMERICAN MACHINIST.

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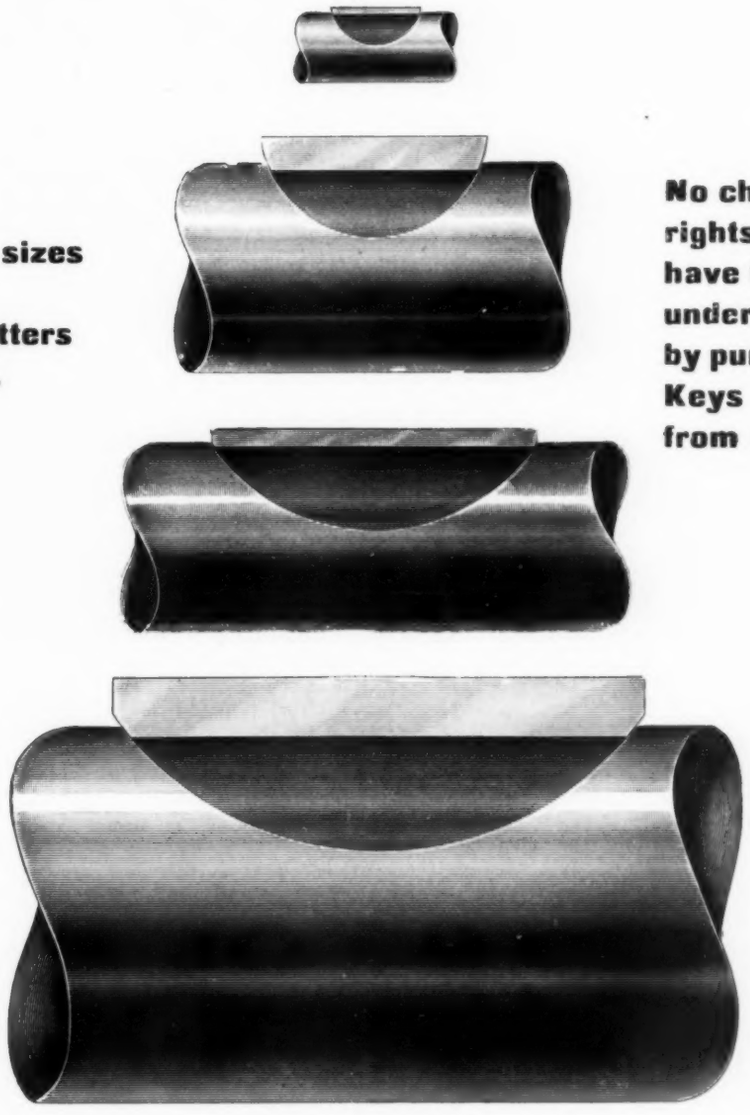

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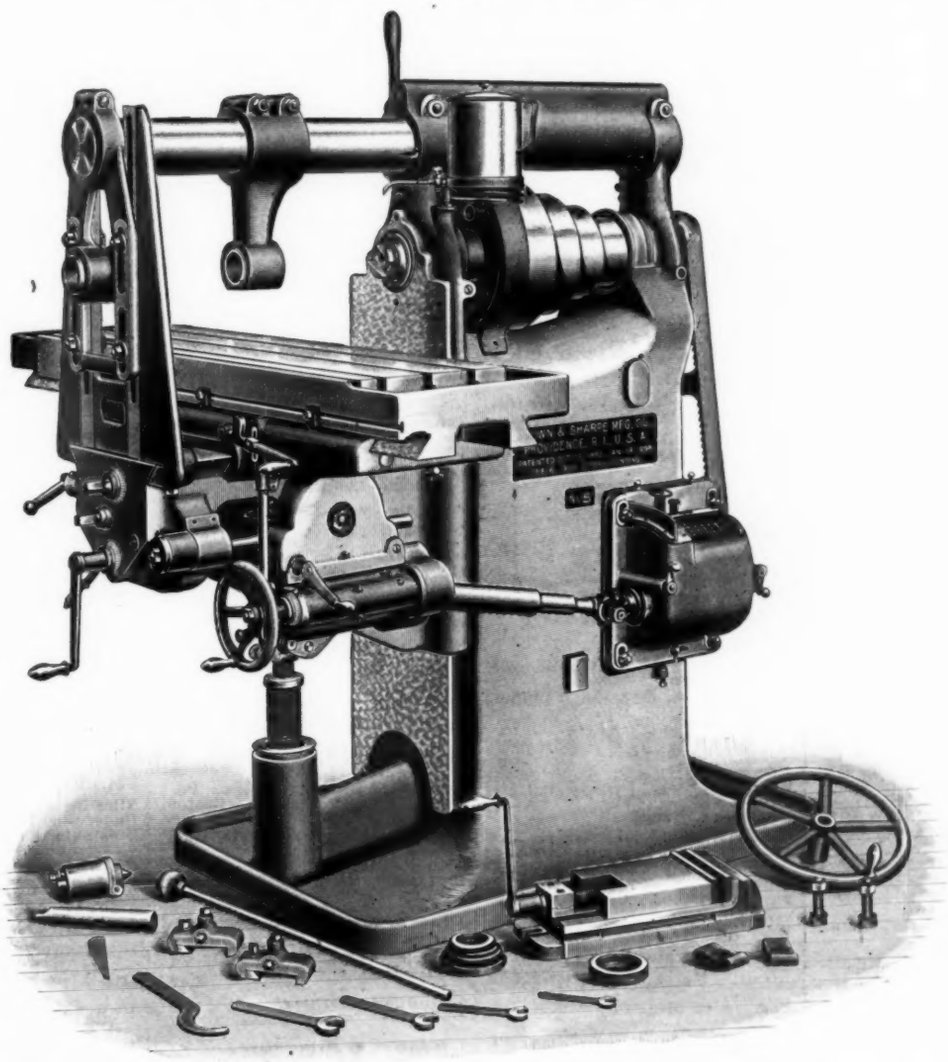

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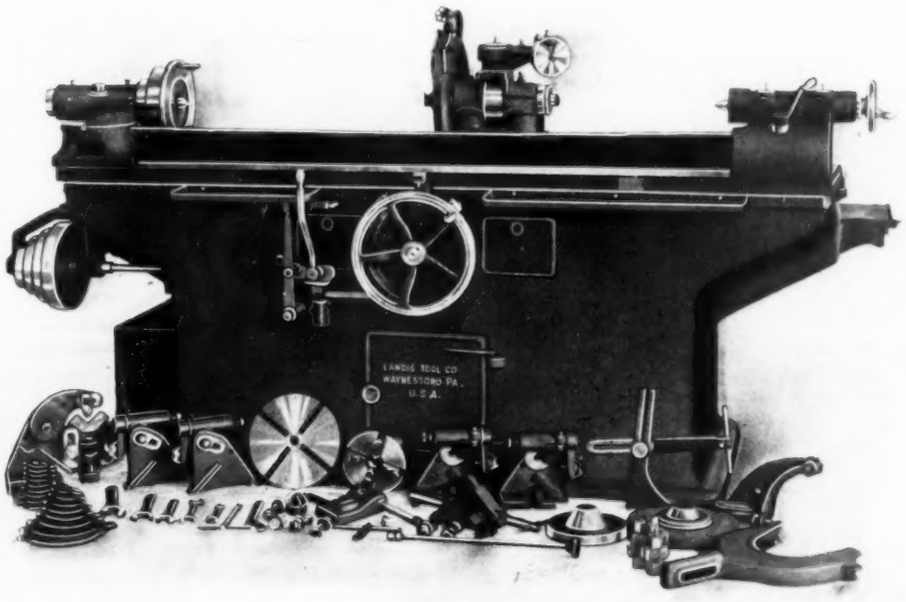

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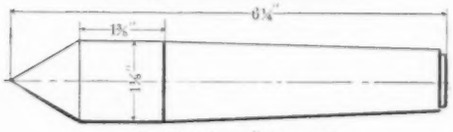

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Oil Dripping and Oil Slinging.

BY HEREFORD BERRY.

Everyone who has designed lines of machines has at times, no doubt, had one which went thru its tests all right, but when it got to the customer began at once to throw oil all over the room. Or perhaps it waited a few months before it began, in either case being productive of rather highly flavored letters which a designer does not particularly care to receive.

With moderately high-speed shafts it is very apt to occur, and even low-speed machines will at times throw a fine spray of oil five or six feet from the bearing, or the bearing may without any apparent cause persistently drip when the machine is running. It is very difficult at times to find the reason, and even after it is found the cure may not be at all easy.

In general there are two broad causes under which practically all cases come. The first is due to defective construction, bad condition, or bad position of the machine or bearing in question; the second is dependent on the speed, or rather the consequence of the speed of the journal. With solid bearings the bush may be loose in the pedestal, either all around or at some point in the upper half of its diameter, thus allowing the oil which drips on to the shaft and journal to work thru to the end without passing over the surface of the shaft. Under these conditions, if it should happen that the top and bottom half of the journal do not match on the inside, a shelf may be left on the lower half of the bearing. Along this oil will travel, and part of it will get outside and drip on to the floor. See Fig. 1 *D*, which shows a bearing which might be subject to the above trouble. Or the top and bottom half of the bearings may not come together,

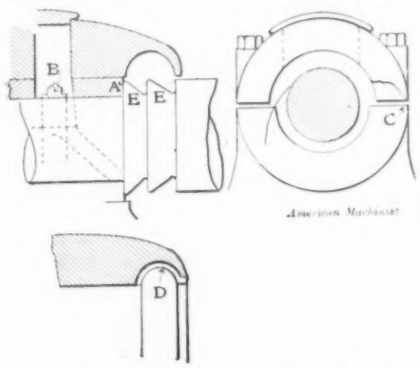


FIG. 1. BADLY FITTED BEARINGS AND OIL SLINGERS.

leaving a small crack *C*. The oil will work along this crack until it gets to the bearing lip; there part of it will go inside and a considerable portion will run down the outside of the pedestal.

Both of the above cases are very hard to find, and it is well to make absolutely sure that they are not the offenders before seeking the trouble elsewhere. The cure is obviously to file, scrape or pack with sheets of tinfoil to a perfect fit.

The drains from the lip to the oil chamber may be wholly or partially clogged with sand, cotton-waste or rust. This of course is easily detectable and readily remedied. The machine may be out of level —*i. e.*, the shaft may not be perfectly horizontal. Any great divergence from level will, in many cases, cause the oil to run out of the inside lip on one end and the outside lip on the other end. The fact that the oil does this may be taken as a

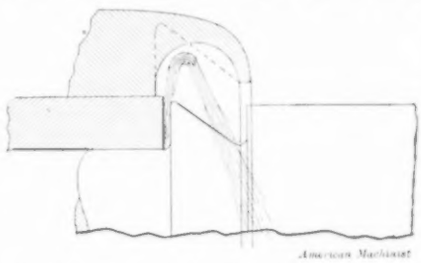


FIG. 2. OIL STRIKING CURVED SURFACE OF OIL LIP.

fair symptom that a machine is out of level.

The above may be taken as a fair résumé of the most common cases of drip caused by defective construction or setting, leaving out of the question all consideration of cracks or injuries to the bearing or pedestal, which are usually easily seen. Any of them will cause oil dripping, either on slow or high speed shafts, but as they are practically from causes entirely apart from the shaft they will hardly ever drip directly on the rotating parts, except in the case of draft slinging which is considered later.

Passing now to oil sling due primarily to the speed of the shaft, we have a rough dividing line between the speeds to which the ring lubrication can be applied and those for which it is necessary to use forced lubrication.

Taking up the first division, it is quite possible to reach a point where the ring itself, if it is at all thick, in a direction perpendicular to the shaft as at *B*, Fig. 1, will throw a wheel of oil against the bearing, having much the general appearance of a pin-wheel. Obviously, if the cover on the top of this bearing has an opening in line with this oil, a very large amount will come thru it and drip down the side of the pedestal. An easy cure for this is to make the oil ring very thin and broad in proportion to its thickness, also it should be kept flat on the top, as the oil will tend to flow up on to the higher portion and will finally fly off from the projection. In all ring lubricating shafts a comparatively small amount of oil passes thru the journal to be returned at the lip, but with certain combinations of shaft and pedestal, we may get bad oil slinging. A very common form of so-called oil slinger on the shaft (and I may remark that in many circumstances this does not belie its name) is shown in Fig. 1, *E E*.

As long as the shaft fits tightly against the bush there will be no trouble, but in the nature of things this is not possible for long; some slight wear will always occur. As soon as this gap at *A* becomes at all apparent, the thin annular ring of oil which fills it will be rotated at a sufficiently high speed to break and fly outward. When this point is once reached, everything depends upon the shape and position of the parts for returning the oil to its chamber. If the bush is slightly inside of its seat at the end, the oil will strike against this projection and be spattered on the shaft, and in many cases on the floor. If the oil lip is rounded, as it is in almost all designs, the oil will strike against the inner curved surface and, following a helical line, will spurt violently out of the end of the bearing. This action is shown clearly in Fig. 2. Further than this, the oil so violently spurted into the lip will foam badly and will be one of the causes of oil slinging caused by draft. The oil lip may be so formed as to force the oil to flow inward instead of outward, as shown by the dotted lines, but practicaly it is impossible to count on the casting always coming out of the sand to this shape, and a better remedy for the above state of affairs is to make the shaft to come out of the bearing with no oil slinging collars whatever. A number of experiments have proved that if the shaft comes out of the bearing with no projections near its point of emergence, there will be no oil slinging. Probably this is due to the fact that not enough oil can collect in the corner, where the shaft

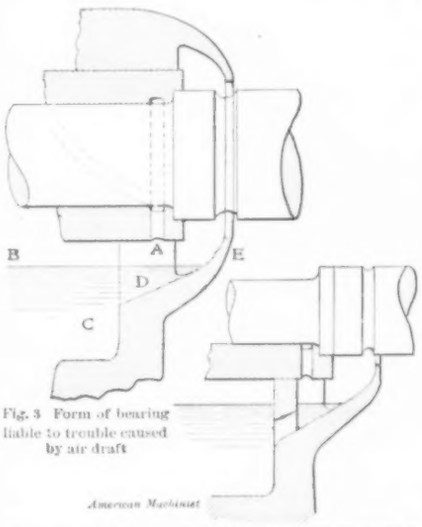


Fig. 3 Form of bearing liable to trouble caused by air draft

FIG. 4. FORM OF BEARING TO CURE TROUBLE CAUSED BY DRAFT.

emerges, to get up a velocity so high that the ring of oil will break and fly outward. A method of attaining this is shown in Fig. 3, which also shows how the end thrust is taken up without permitting the annular ring to break up, together with a groove to allow most of the oil to escape before it reaches the thrust collar. A groove or projection should be made some distance from the point at which the shaft leaves the journal, in order that the creeping of oil or running of drops along the

shaft when the machine is idle may be prevented.

A most perplexing form of oil slinging is that caused by draft, and which is apt to take place in electric motors or generators, or in high-speed machinery which has a strong inward draft or which forces a strong current of air across the bearing. The usual construction of bearing, shown in Fig. 3, in which *B* is the oil level, *C* is oil chamber, *D* is oil return, *E* is the oil lip and *A* is the oil drain, is subject to this form of trouble. Its cause is as follows:

You will observe that the air can pass across the surface of the oil thru the whole length of the bearing, thru the oil returns. As soon as the machine is run and the oil gets heated, considerable foam is produced by the oil rings, which foam is driven by the draft over one of the lips; the one nearest the machine in the case of a machine with an inward draft—which case is the most common. This foam, as the bubbles burst, forms a drop of oil on the outer lip, which would be expected to run down the outside of the pedestal, but the draft on the outside of the pedestal, and near to the machine, is very strong, and a succession of drops are drawn into the rotating part and distributed over the whole machine and pretty well over the room as well. An easy means of curing this is to so design the bearing that the oil returns dip below the surface of the oil in the inner chamber, as shown in Fig. 4. This stops all the thru draft and will, in almost every case, stop the slinging. It is most important that the passage of air over the surface of the oil in the bearing be entirely stopped, as even a light flow will at times cause drip. For bearings already made small sheet-metal gates may be fitted in the return passages, with a hole at the bottom to permit the oil to flow into the well; care being taken that this hole is below the surface. It is to be noted here that all the other causes of drip should be first investigated, as of course any of those conditions which cause oil to collect on the outer part of the lip will give very much the same results, except that usually a smaller amount of oil will be thrown.

Taking up the case of those bearings in which forced lubrication is used, the conditions are considerably altered, and tho both high-pressure, forced lubrication—*i. e.*, pressures of from 3 to 5 atmospheres—and low-pressure lubrication, which is usually at about 3 or 4 pounds, present differences, they have very much the same effects, differing mainly in quantity. The oil is introduced as a rule either at the bottom or sides of the shaft, and is forced to leave at the ends with considerable velocity.

It is plain that if the shaft came straight out of the bearing with no projection, the oil would spurt directly along it, and would be only partially stopped by a groove just inside the edge of the bearing, which by the way should always be used, in order to keep down the speed of the oil as much as possible. In this case, therefore, projecting collars must be used. They should be large and the lips of the bearings should be large. Great care should be taken that they are smooth inside, and that the velocity of oil is reduced as quickly and with as little foaming as possible.

Any of the cases caused by bad construction will be aggravated under forced lubrication, and we have further cases (due largely to the quantity of oil delivered) to contend with here. The lips may not be large enough. The drains from the lips to the return pipes may prove too small, or have too little inclination, as shown in Fig. 5, the dotted lines of which represent the proper slope, or the drains themselves may be too small or too long, and the oil may stand entirely too high in them, due to the oil receiving chamber being at too high a level. I might mention, in passing, that it is difficult to run

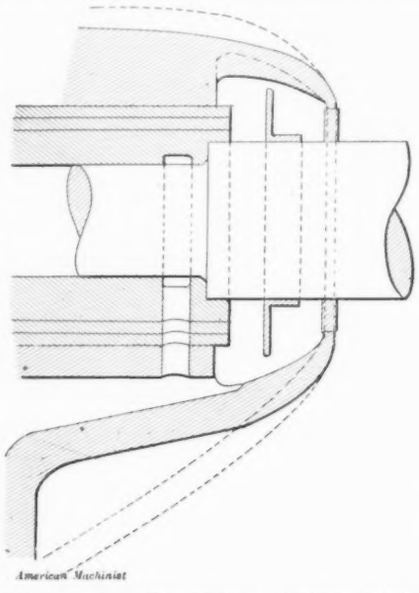


FIG. 5. INCORRECT DESIGN. CORRECT SLOPE SHOWN BY DOTTED LINES.

any member of a very high speed machine, such as a coupling, in a flooded chamber, as the projections on the coupling churn the oil to such an extent that the pedestal very quickly reaches a prohibitive heat, and we have a particularly bad case of foaming, which when the oil is forced again thru the journals greatly increases its liability to drip.

It may be thought that I have made too much of this question of oil slinging, but it will perhaps be appreciated by those who have at times had a particularly obstinate case to deal with, which apparently would not down, and I hope that these remarks will prove of some interest.

The Riehle Bros. Testing Machine Company, of Philadelphia, are building for the University of Illinois a 600,000-pound testing machine, which the builders say is the largest vertical-screw, power testing machine ever built.

Making Chemical Tablets.

BY A. B. MIGRAINE.

In the manufacture of dies for tablets it is imperative to use fine, close-grained steel. There is one brand particularly adapted to this work, as it will stand quite a heavy internal pressure; it is also adopted for drop dies and for swaging. If the proper steel is not used, rings will form in the side of the die at the place where the tablet is formed and when once a ring is formed the die is useless. The dies should be hardened with care and as hard as it is possible to harden without destroying the fine structure of the steel. Some of the compounds formed into tablets contain ingredients which are very destructive to the die and will wear it away in a surprisingly short time in spite of any amount or mode of hardening.

Any toolmaker who is familiar with ring and gage work should find no difficulty in giving satisfaction on dies for chemical tablets. The dies used are mostly round in the hole and perfectly parallel and are turned and ground concentric with the hole, which is reamed to within .003 inch of the size and afterward lapped. On even large dies the hole is ground and highly polished so as to be without a scratch. For some compounds which are hard to run, it will be found of some advantage to give the surface a transverse polish, as in drawing dies, and thereby eliminate the microscopical circular grooving which will result from using a rotating polishing lap. In using a die with a ring the goods naturally will "cap" and thereby render it useless. Goods will cap from other causes. One of the most common is, if the mixture has not sufficient natural adhesive quality to hold the material together after compression, or if the granulation is too fine so that it feels more like flour than granulation. In both these cases the best plan is to send the stuff back to the chemist for his manipulation.

The best polishing compound that I have found is that used on fine cutlery. The faces of the dies are straight and square with the hole, and they must be polished, but not as smooth as the hole. The reason for having the faces smooth is that the feeding shoe in passing over the die to deposit the required amount of material will always leave a small portion of dust and this will gum with the friction of the shoe and hold the shoe back long enough so that it will not give an even deposit in the die and consequently not an even weight.

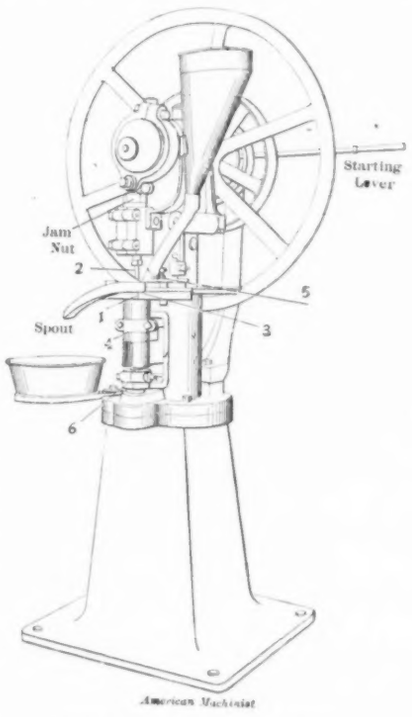
The punches run from ⅛ to 1½ inches, but nothing larger than ¾ inch is used in the machines which we here have to do with. The larger percentage comes under ½ inch, and generally ¼-inch Stubs steel is used for the punches. There are all kinds of odd punches used in making tablets. Some are flat in the face and others are engraved. The majority of punches used are concaved to a standard depth. Different manufacturers adopt their own

standard for depth and some are more exacting than others. As a general rule, there is a standard depth gage for each size of punch. Too much stress cannot be laid on these points; it is very important that all punches of one size should have an equal depth and run perfectly true. This is necessary because the tablets are made by weight and also to gage for thickness, and should the punch not have the proper depth or shape it will not compress to the right gage and the tablet in use will be too hard or too soft to desintegrate in the precise time desired.

It is customary to rough out the concave before hardening and to grind and polish to a fine edge by means of an emery or carborundum wheel properly adapted for the purpose. A wheel 1½ inches diameter by 3-16 inch thick and trued up with a curve on the outside surface will give the depth for a ½-inch punch. When the wheel wears you true it down with the diamond to the next size, which is 15-32 inch, and so continue until it becomes useless for the smallest size. The punches run in differences of 1-32 inch, and these sizes will, as a rule, give all the range of variation in weight and gage that is necessary. Punches and dies are always kept in stock, and in making stock my experience has taught me that 60 per cent. of the materials will run on dies with .005 inch clearance, 30 per cent. will run good from .001 to .002 inch of clearance, and the rest will have to be specially adapted to the materials used.

The press here shown will be seen to be of different construction from that of the average sheet-metal press. There are quite a number of presses of different construction for this service, but the one here shown is quite popular with chemists in general for its simplicity. There are two important motions worked by cams: one lifts the bottom punch, and the other works the shoe that gives the shake and also the lateral motion that feeds the die. To operate the press, place the bottom punch in holder 1 and the top punch in upper plunger 2; place the die in bed 3 and fasten the die level with the die bed. Turn the flywheel until the lower punch rises to its highest point, being careful that the punches don't meet and thereby destroy the fine edges. Turn the wing screw 4 until the upper punch is level with the top of the die; not above, as that would cut a groove in the shoe and let the powder out, and also ruin the lower punch. Place the feeding shoe 5 on the die bed, not too hard, as that would cause it to bind. Drop the pin in the center of the shoe and also the feeder arm pin; connect rubber hose with the shoe and cam feed, and you are ready to take the weight. Turn the wing nut 6 to right or left, as you wish to increase or decrease the weight, and after getting the right weight tighten the screws; place the table spout on and also the receiving pan. To regulate the pressure, loosen the jam-nut on plunger 2, turn the flywheel until the top punch enters the die, and turn the plunger, by means of the hexagon on bottom, to right or left, according to pressure desired. After binding all loose parts we are ready to start.

The presses run from 80 to 125 revolutions per minute, they are self-feeding and on each revolution you will get a tablet or lozenge. While the press is in motion you have to look after goods lapping, chipped edges, specks, tits, unevenness in weight, gage or shape. It must be looked after that the tablets are sufficiently hard to stand coating, or while in transit; they must be tested to see that they disintegrate at the proper time, and there are many other things which the diemaker will be blamed for if they occur, and sometimes if they don't. Some



PRESS FOR CHEMICAL TABLETS.

goods must be run off at different temperatures, and much depends on the condition of the weather. Such tablets as Lithia are best run in a special room, called the hot room, where the temperature is 120 degrees Fahr., and every particle of moisture is absorbed by chemicals placed in the room. This room also is filled with hot-closets, where the granulations are kept, both for the purpose of absorbing the moisture as well as to keep them ready for the machines.

In making up engraved punches, be sure to give a liberal amount of draft to the raised part, also make it smooth and highly polished, as otherwise the powder will stick to the engraving.

In the majority of factories they have a poor equipment for the machine shop, and a diemaker has to devise all kinds of ways to accomplish good results. It is well for a mechanic also to know that his superior will be a chemist and, as a rule, has only the average mechanical knowledge of the everyday intelligent man, with poor judgment as to the time or the ways to accomplish certain jobs.

After the tablets are made they are placed over a suction blower, to remove all loose powder. From there, if the order calls for coated tablets, they are sent to the coating room, where the copper revolving pan awaits them to coat them with the right colored syrup. After that they are placed in another pan lined with heavy felt, and a few cakes of paraffine are thrown in, and by revolving them they receive that high polish found on all first-class goods. The next place they are sent to is the counting room, where machines automatically deposit a given number of tablets in a bottle placed underneath; from there they get labeled, checked and wrapped ready for shipment. It is almost unnecessary to say that in every operation the greatest care in guarding against mistakes is taken, as these would prove very costly to the firm.

There are some punches that are very odd in shape, as, for example, one to imitate a coffee bean, but larger. These are used for travelers, in the army, etc., where a concentrated extract is used, and as they take up little space, are very popular; tea also is put up in this way. From hypodermic tablets to the larger bath perfume tablet, all are made on the same principle, and with the same care in the selection of drugs, weights, etc.; which is one of the reasons why physicians have taken so well to them. The larger tablets must be made in a heavy, substantial press, as the pressure in compressing a tablet is very great.

Here are given some of the principal things that are liable to occur in forming tablets, with suggested expedients. If the goods bind, try a larger die. If a ring forms in the outer edge, the die is too large. If the edges are broken, the material is not sufficiently adhesive and will not hold together. If only on the bottom edge, the bottom punch is too small in diameter, or the sharp edge of the punch is gone. If the tablets appear with irregular specks, the goods are not thoroughly mixed and must be sent back. If the tablets don't run with even weight, the shoe is binding, or the punch is sticking, or the goods are too sticky and don't run freely from the funnel. If crooked tablets appear, the causes are that the shoe has taken off part of the bottom punch, or the die is not resting square with the punch, or the punch was ground in the concave when it did not run true. There are more causes why these things will happen, but the ideas as to how to overcome them will suggest themselves to the diemaker.

The St Louis Exposition—XI.

EDITORIAL CORRESPONDENCE.

THE BALTIMORE & OHIO EXHIBIT OF OLD LOCOMOTIVES AND REPRODUCTIONS CONCLUDED.

In Figs. 25 and 26 we go back again to the name of Timothy Hackworth. These two illustrations show, respectively, the "Samson," built by him in 1838, and the "Albion," built in 1839. Except for the "Sans Pareil," these are among the oldest of Hackworth's locomotives. The "Samson" was installed on the Albion Mines road, connecting Stellarton with Pictou Harbor, in Nova Scotia, in 1838, and the "Albion" followed in 1839. The former continued in use for forty-five years, and the latter nearly as long. In the case of the "Samson," the engineer's post is at the front end of the engine, while the fireman's place is at the rear, the boiler having the single return flue of the "Sans Pareil." The gage cocks and the steam gage are upon the side of the boiler, and the engineer had to leave his post in order to inspect either. The cylinders are vertical within a housing at the engineer's end, the piston rod being fitted with a parallel motion instead of a crosshead, and the brasses now in place in connection with this link work are said to be the original ones. It is sufficiently obvious from the illustrations that these engines of Hackworth's were no toys. Attached to the "Samson" will be seen an old passenger car which came from the same road, and which is undoubtedly the oldest passenger car upon the American continent, and in all probability the oldest in existence. It was ordered at the time the locomotives were ordered, and altho the order comprised but one car, it involved a good deal of correspondence. The car was attached to the rear of the ordinary coal trains in order that those who wished might ride.

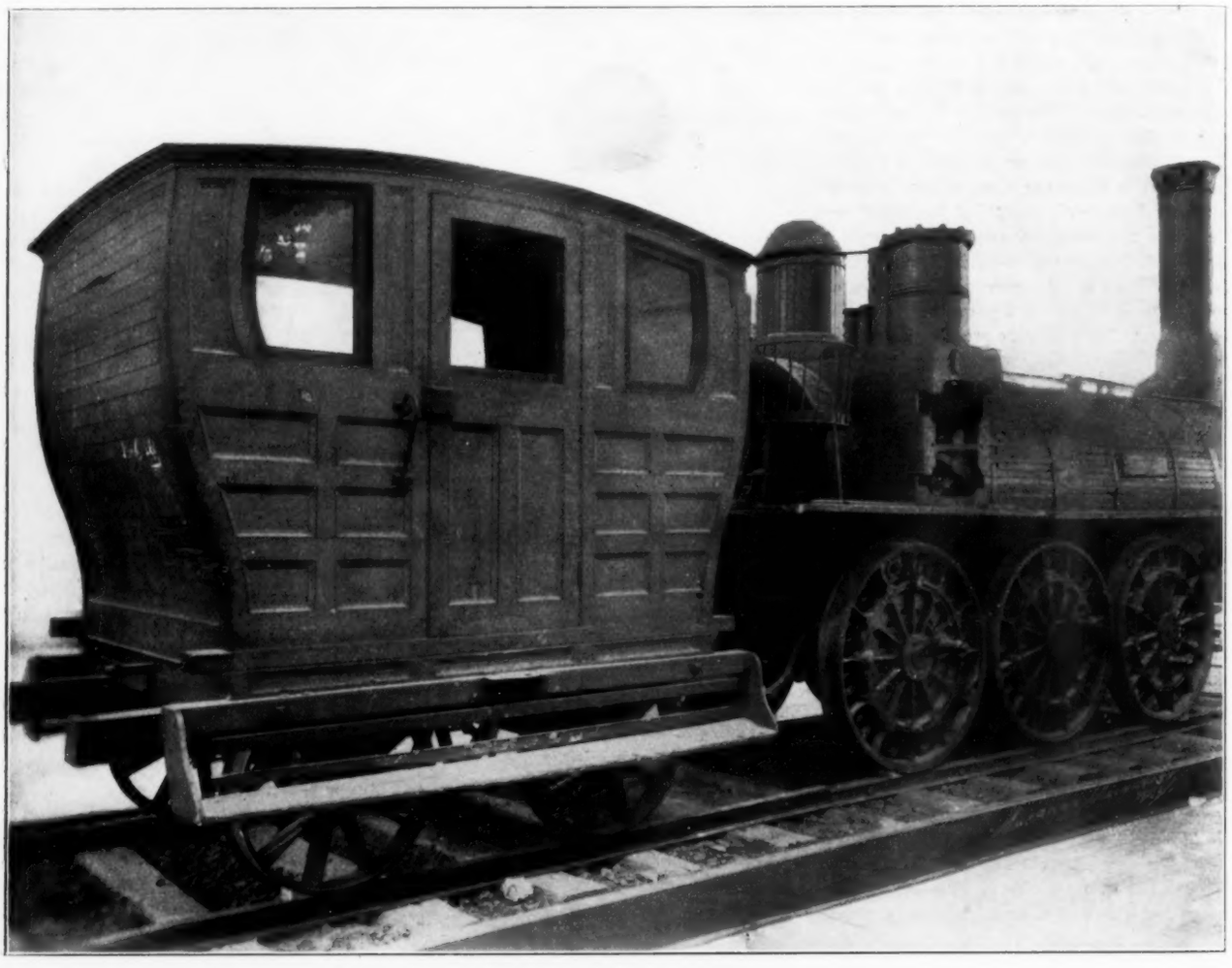


FIG. 25. THE "SAMSON"—1838.

Fig. 27 shows the "Camel," of 1848, by Ross Winans. This name came eventually to designate the type which it represents, and it was the first to have eight driving wheels, as it was the first to have an overhung firebox wider than the distance between the frames. It was also the first to have the cab on top of the boiler, and the first to discard crown bars and rely entirely on sling stays.

In Fig. 28 we have the "Mason," of 1853, by Wm. Mason, of Taunton, Mass. Mason was the first to study the locomotive from the standpoint of appearance. Prior to his time, going qualities alone were considered. He adopted, tho he did not originate, the horizontally placed cylinders and standardized many minor features. His chief work, however, was the introduction of those construction lines which, to American eyes at least, are lines of grace and beauty. The greatness of his work may be best appreciated by contrasting this locomotive with the uncouth forms that preceded it, and also by recalling that it standardized the American locomotive for many years. Indeed, the name given to this type of engine—the "American"—is more significant than anything else of the influence which Mason had upon American locomotive practise. Remove the moldings from the steam dome, sand box, and cab, and replace them with the present rounded forms, and there is not an important line in this whole engine that would not be considered modern to-day.

If the reader will recall that but twenty-four years intervened between the "Rocket" and the "Mason" and sixteen between the "Hercules" and the "Mason" he will understand that rapid progress is not exclusively a matter of our day. The contrast between the "Mason" and Baldwin's "Pioneer" of but five years previous—not here shown—is very striking.

In Fig. 29 we have the "Peppersauce," designed by Sylvester Marsh in 1863 and the first mountain climbing locomotive, being No. 1 of the Mt. Washington Railroad. The boiler is hung on trunnions in order that it may be upright regardless of the grade of the track, and the steam was taken out thru one of the trunnions. The

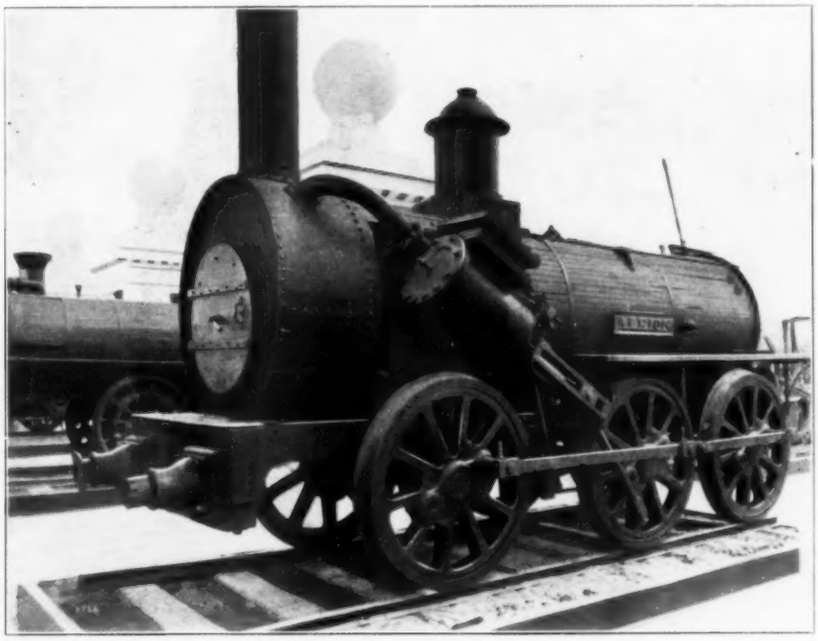


FIG. 26. THE "ALBION"—1839.

crankshaft is geared to the driving shaft which carries a tooth-gear fitting a rack between the rails. The rear carrying wheels have also a tooth gear meshing into this rack, and upon the shaft of these wheels is a special drum for the action of the brake. General Grant and many other distinguished men have been taken to the top of Mt. Washington by this little locomotive.

Finally in Fig. 30 we have the latest mountain climber—the lordly "St. Louis" of the Baltimore & Ohio by the Schenectady Locomotive Works, and seen also in part in the background of Fig. 29. The engine is an articulated Mallet machine having twelve wheels, all of which are drivers. Four cylinders drive these, as shown, the frames carrying the wheels and cylinders being jointed or articulated. The rear cylinders are high and the forward ones low pressure, tho boiler steam may be turned directly into the low-pressure cylinders in starting and when otherwise needed, thus increasing the tractive power about 20 per cent. The weight without tender is 334,000 pounds and the tractive power 71,500 pounds.

To the engineer walking down these long aisles—for the exhibit is 500 feet long with a row of these old fellows down each side and another down the middle—the feeling is that he really ought not to keep his hat upon his head. With the general public the effect is, of course, otherwise, for, to such, these early efforts look like the feeble and ludicrous steps of babes and many a jest is heard. The engineer of to-day, who has at his elbow pocket books, reference books and a technical literature containing the experience of a century and placing knowledge of what has been done almost on tap, cannot but reflect that these things were done when no one had done anything, when no one knew what could be done or if anything could be done, and moreover when invention had not, by placing behind it a long history of achievement, led the public to believe anything to be possible. To him these things are not the feeble steps of infants but rather the uncertain steps of blind giants, for truly "there were giants in those days."

F. A. H.

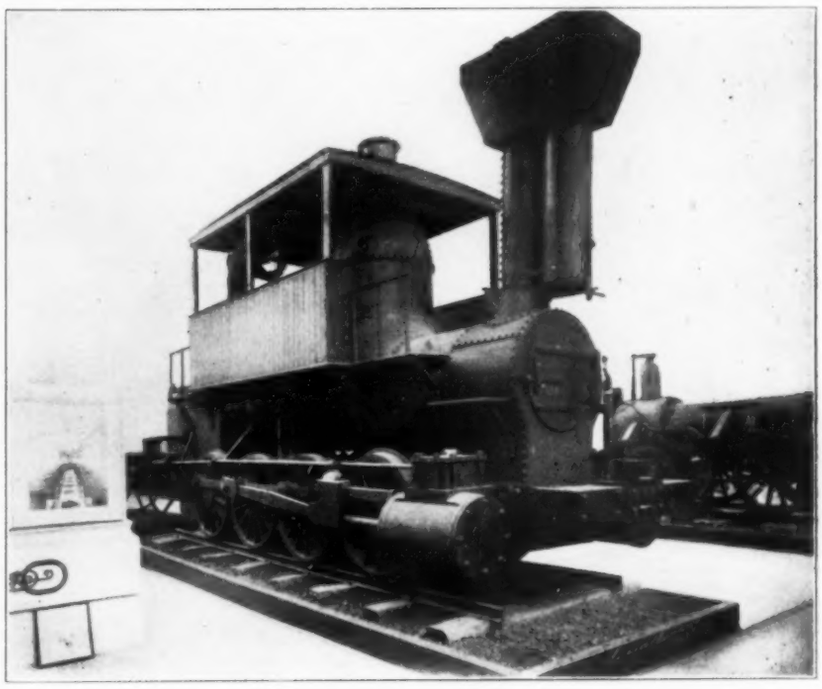


FIG. 27. THE "CAMEL"—1848.

A Shop School.

The Houston, Stanwood & Gamble Company, Cincinnati, Ohio, are manufacturers of slide valve steam engines as a specialty. In connection with their machine shop they have started a shop school in an adjoining residence for apprentices. In this school the apprentices each spend six hours a week of the shop's time under pay. There are eighteen apprentices, fifteen of whom are signed, the other three are on probation. On the first of February last, when the school was started, all of the apprentices were invited to attend. Two did not desire to accept the invitation and one subsequently dropped out. The three who are on probation have not as yet entered, but will do so if they are found to be of suitable material so that the company feels warranted in making an apprenticeship contract with them.

Recently the company purchased the Western Foundry Company's plant, which is located immediately across the street opposite the machine shop. It is the intention to offer the same opportunity to attend school to the foundry apprentices that the machinist apprentices now obtain.

The attendance is not compulsory. Most of the apprentices have willingly seized the opportunity offered, while one or two after a little talk, saw the advantages of the situation. No mention is made in the apprenticeship contract of the existence of the school and no requirements are inserted as to attendance.

It will be seen from the above that there are in all twelve pupils. These are divided

into four groups of three each. One group goes to school from 8 to 10 o'clock, another from 10 to 12, another from 1 to 3, and the last from 3 to 5 o'clock, on Mondays, Wednesdays and Fridays.

The teacher is a young man who has had a good manual training school course. He has also had some experience as an assistant teacher in a manual training school. On Tuesday, Thursday and Saturday mornings he is employed in clerical work in the cost department. With the exception of the warm summer months he is expected to be in the schoolrooms Tuesday and Thursday evenings and Saturday afternoons, so as to assist apprentices who may wish to use the schoolroom as a study or drafting room.

The three subjects taught are mathematics, English and drafting. In mathematics, so far, the work of these lads has been in the nature of a review of arithmetic for the more advanced, and instruction in elementary arithmetic for those who need it. It is intended to follow arithmetic with elementary algebra and geometry to be taught in as concrete a manner as possible. In the mathematical work it is the aim to select examples from shop practise and engineering work as far as is practicable.

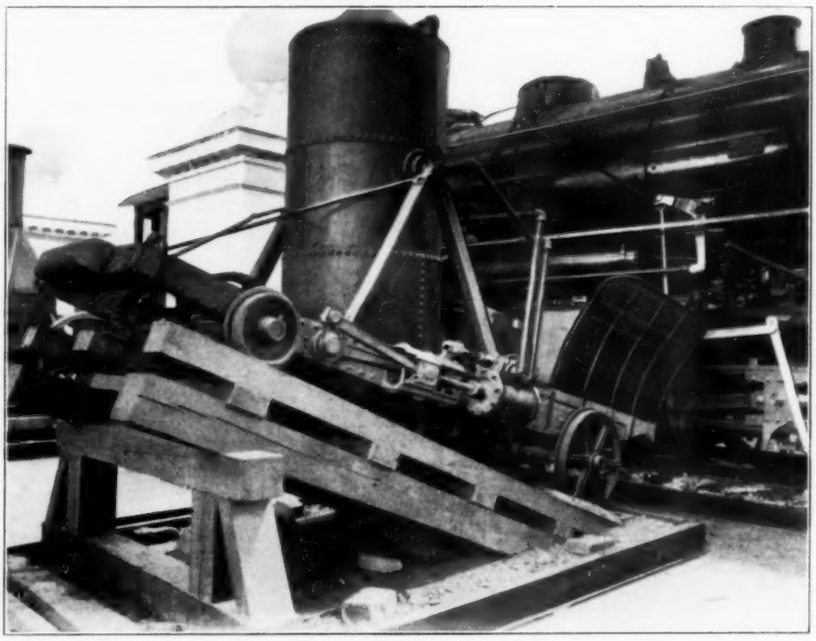


FIG. 29. THE "PEPPERSAUCE"—1863.

In English, two or three dozen copies of boys' books have been purchased, such as "Treasure Island," "Oliver Twist," "Midshipman Easy," "Around the World in Eighty Days," "The Last of the Mohicans," "Chordal's Letters," etc. The boys

FIG. 28. THE "MASON"—1853.

FIG. 30. THE "ST. LOUIS"—1904.

are generally interested in these books and take them home to read. From time to time they are expected to make a written description of portions of the book in hand; criticisms of this work as to spelling, grammar and form of composition are made by the teacher. They are also instructed in the forms of letter writing, etc., while now and then a talk is given on grammar in connection with their work. Adjoining the schoolroom is a reading room, in which is placed current technical literature, such as the AMERICAN MACHINIST, *Power*, *Engineering* and *Cassier's Magazine*, etc. These the apprentices are encouraged to read when they come on Tuesday and Friday evenings and Saturday afternoons.

In drafting, the instruction has been very simple, with a few preliminary exercises in the use of compass, triangle and drawing pen. Most of the time has been spent in detailing from measurement taken parts of the engines which this company manufactures.

This school is something of an experiment. Young men with sufficient education for future development are usually not willing or patient enough to spend time in the shop to secure a practical knowledge of the business. On the other hand, the average apprentice is usually not sufficiently well educated, even in an elementary way, to develop later when skill and general education are needed. It is to meet this condition that this school has been started. It must not be supposed that the lads who did not wish to attend school will on this account be considered poor material by the company; indeed one or two of them are excellent workmen.

Pay Days and Drunkenness.

The Massachusetts Bureau of Statistics of Labor has recently compiled some statistics intended to show the connection between the periodic pay days of employees and their habits of drinking to excess with consequent loss of time. The conclusions reached are by no means discouraging. The number of establishments investigated was 413, in more than forty cities and towns. Taking only male employees sixteen years old and over, the average number at work on Saturdays was 39,761, and 1,614 of these would not be at work on Monday. Of the absentees 1,103 were away on account of sickness or for other acceptable reasons, while 511, or 1.29 per cent., were said to be simply drinking. The percentage varied greatly. In Lowell only 0.32 per cent. were absent on account of drink; in Springfield, 1.36 per cent., and in Quincy the percentage with the granite workers was 7 per cent. Employers of labor generally testified that the weekly payment of wages has little to do with drunkenness. With monthly payments the drinkers would remain on debauch much longer than now. The general testimony is to the effect that in recent years there has been great improvement.

The Development of a Remarkable Turret Lathe—II.

EDITORIAL CORRESPONDENCE.

While the hydraulic machine with friction driving disks, as described in the preceding article, was being constructed at the Jones & Lamson shops, experiments were being made there in connection with modifications of the Sellers disks for driving the feed mechanism of the regular 2x24 machine; and after a little while the form shown in Figs. 8 and 9 was devised and upon application found so satisfactory that the design in its essentials has been retained in the flat turret lathe with new head, practically the only change in the latest disk construction consisting in making the male solid and applying pressure springs to one of the female disks.

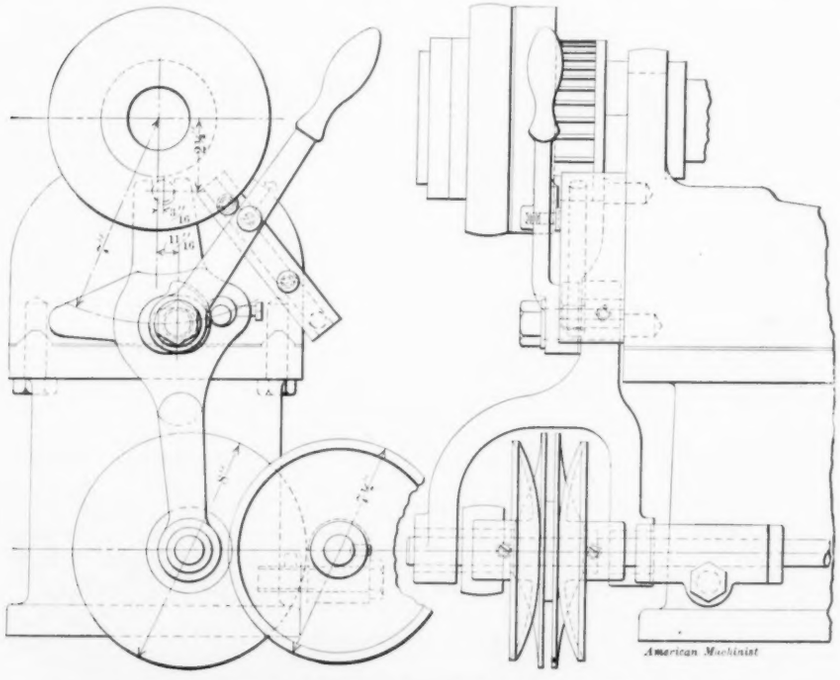


FIG. 8. ARRANGEMENT OF FEED DRIVING DISKS FOR 2 X 24.

The method of mounting and driving the disks and of controlling with cam and lever will be understood fully from Fig. 8; the sectional view, Fig. 9, drawn to a larger scale, will show more clearly the outline of the curved faces by which a slight swinging movement of the male or driving disk increases or decreases greatly the speed of the driven or feed shaft. The driving and driven disks, which are respectively 8 and 7½ inches in diameter, are represented in the relative positions they occupy when the feed rod is running at its highest rate of speed. To reduce this speed to the lowest possible rate and thereby decrease the carriage feed from about 0.07 to 0.008 inch per turn of spindle, it is necessary to adjust the driving disks only about one-half inch nearer the center of the feed rod, this slight movement transferring the line of contact on the driver from a circle of 3 13-16 inches radius to one having a radius of but 1 inch, the radius of the contacting circle on the driven disks at the same time being increased from 1 5-16 to 3 9-16 inches.

Just before the adoption of this form of feed disk for the 2x24, the construction of a 2½x25-inch machine like Fig. 10 was undertaken; and as the time seemed hardly ripe for the placing before the mechanical public of hydraulic turret lathes (altho the five built were giving satisfactory results) this machine was equipped with a geared feed driven from inside the head and having seven changes obtained thru the medium of sliding keys.

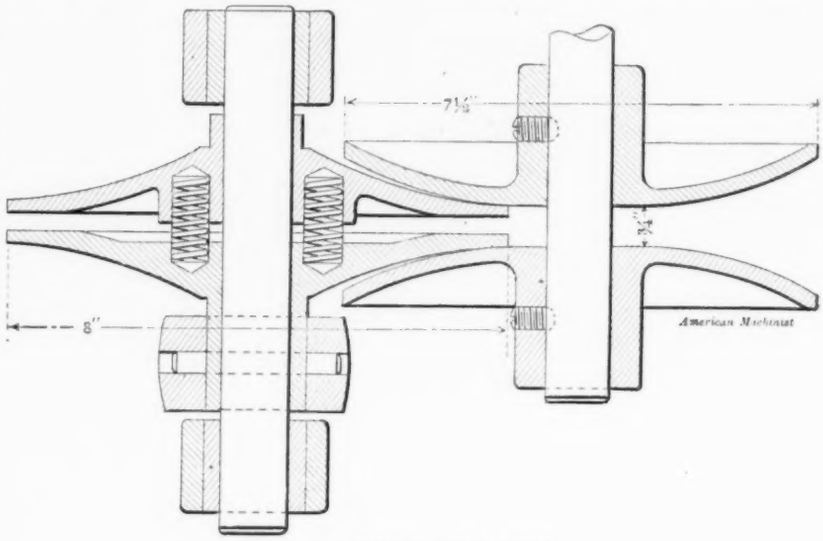


FIG. 9. SECTION THRU DISKS.

The entire head gearing is enclosed as represented in the half-tone, and the mechanism is so arranged as to give the spindle eighteen speeds without making necessary a change in the speed of the driving shaft, which was originally designed to be driven by a constant speed motor connected direct to the shaft. A horizontal section thru the spindle is given in Fig. 11, and it will be seen that in this head were employed for the first time the self-adjusting boxes which in modified form are utilized in the new model head. The spindle, up to this point made with cylindrical bearings at each end, was here provided with a cone bearing at the front and at the rear fitted with a shell coned on the outside, to allow the springs backing up box and shell to keep them properly adjusted to the spindle.

The drive is taken by shaft *a*, Fig. 12, and transmitted thru the mechanism shown to shaft *b*, which is geared as in Fig. 11 to the spindle and which thru the system of gears and clutches obviously has six changes of speed. Thru gears *c* and *d*—when the latter is clutched to the gear to the left—the spindle may be driven direct; or with *d* left free, as indicated, the power may be transmitted thru shaft *e*, giving two back-gear drives corresponding to the back gear and triple gear of the regular 2x24 head. The spindle therefore has three rates of speed to each speed of shaft *b*, a total of eighteen speeds. The reversible silent pawl and ratchet used in the last hydraulic are employed here in connection with gears *f* and *g*, thus shaft *b* and the spindle, if in motion, will be driven at a constant low rate of speed until the faster gears are thrown into action.

The feed gear will be understood from Fig. 13. The drive for shaft *h* is derived from a gear on the spindle, and the two gear cones and the pinion on this shaft operate seven gears on shaft *i*, which by means of the bevel gearing shown is connected to the feed rod. The seven gears are freely mounted on the shaft and the latter may be moved endwise, to allow spring keys with which it is fitted to engage any one of them. These keys are placed in pairs, and the two pairs are so located that when a gear is engaged by a key the other keys are midway between the keyways in two other gears. A move-

ment of the shaft equal to half the thickness of a gear hub is therefore sufficient to disengage one gear and connect another, and only a short movement is required to cover the entire range of gears. As will be noticed, the two gear cones on each shaft are so proportioned that those at one end form intermediate steps between those at the other, this allowing the speed of shaft *i* to be steadily increased or decreased as the sliding keys are drawn thru from end to end. The feed rod is driven in either direction by reversing gears at *j*.

The forming and cutting-off tools are carried on this machine by a heavy arm pivoted to the head, as illustrated at Fig. 10. At either end of the arm is a hardened steel roll, and when the arm is swung downward the roll at the lower end is engaged by a coarse pitch worm keyed on the pilot wheel shaft under the chuck, and the tool is then forced into the work by turning this shaft. The tools are adjusted easily in their carrier and stops at either side determine the amount of movement given the oscillating arm. This machine was the first in which the double system of stop bars for the turret slide was employed; and in the photograph will be seen at the rear of the slide the handle by which these twelve stops are controlled.

I wish now to mention a little experience with friction disks having curved contacting surfaces, which seems to show that after a certain high periferal velocity has been attained, these exceedingly useful affairs may have their "shortcomings." Fig. 14 will illustrate a method of driving a 2x24 spindle devised and tested shortly after the application to the feed rod of the disks shown in Figs. 8 and 9. The idea was to secure a variable speed drive from a constant speed shaft without altering materially the 2x24 standard construction. The power was taken from the motor-driven shaft projecting at the end and speed variation was secured by means of the long cam lever, this operating a swinging bracket which carried the lower or driving disks. The spindle was reversed by the clutches and gears shown clearly in section; and was actuated by a silent chain passing over sprockets, as represented by the dotted outline.

Altho this arrangement was successful, so far as spindle actuation was concerned, it was, after a little, abandoned. For, owing to the high periferal velocity of the disks, which in the case of the 11-inch drivers running at 1,400 turns, was about 4,000 feet per minute, the discomfort imposed upon all within the vicinity of the high speed and consequently noisy device was entirely disproportionate to the satisfaction derived from the convenient control of the spindle speed. So, after its characterization by one of the firm as a "howling" success, this drive was dropped.

The satisfactory results already derived from the employment of the friction disk drive for the 2x24 feed rod and from the entirely enclosed geared mechanism for driving the spindle of the 2½x25-inch machine in Fig. 10, led in 1903 to the combining of modifications of these two features in the 2½x36-inch machine shown in Fig. 15. In this design head, bed and pan are formed integrally. Sections thru the head are given in Figs. 16 and 17, and will be understood without much of an explanation. The spindle is of the same form as the one in Fig. 11 and has the same self-adjusting bearings, the conical surfaces in both instances being ground to a 5-degree angle or 10-degree included angle; the sleeve, which is free to slide on the rear of the spindle, is ground to the same taper, and both bearings run in bronze boxes. Three speeds, equivalent to direct, back gear and triple gear drive, are derived directly thru the geared mechanism, further speed changes being made thru a variable speed motor connected to shaft *k*, Fig. 17. Shaft *l* when driven by *k* may operate the spindle rapidly in either direction by means of gear *m*, reversing gears *n*, intermediate *o* and spindle gear *p*; or the spindle may be driven by means of the gears on shaft *q* and friction gears below. The clutches controlling the different gears are clearly shown and require no special description.

It will be noticed that the silent ratchet and pawl are applied to gear *r*, the pawl in this case being non-reversible as the reverse is obtained through the gears and clutches at *n*. There also are used in this head

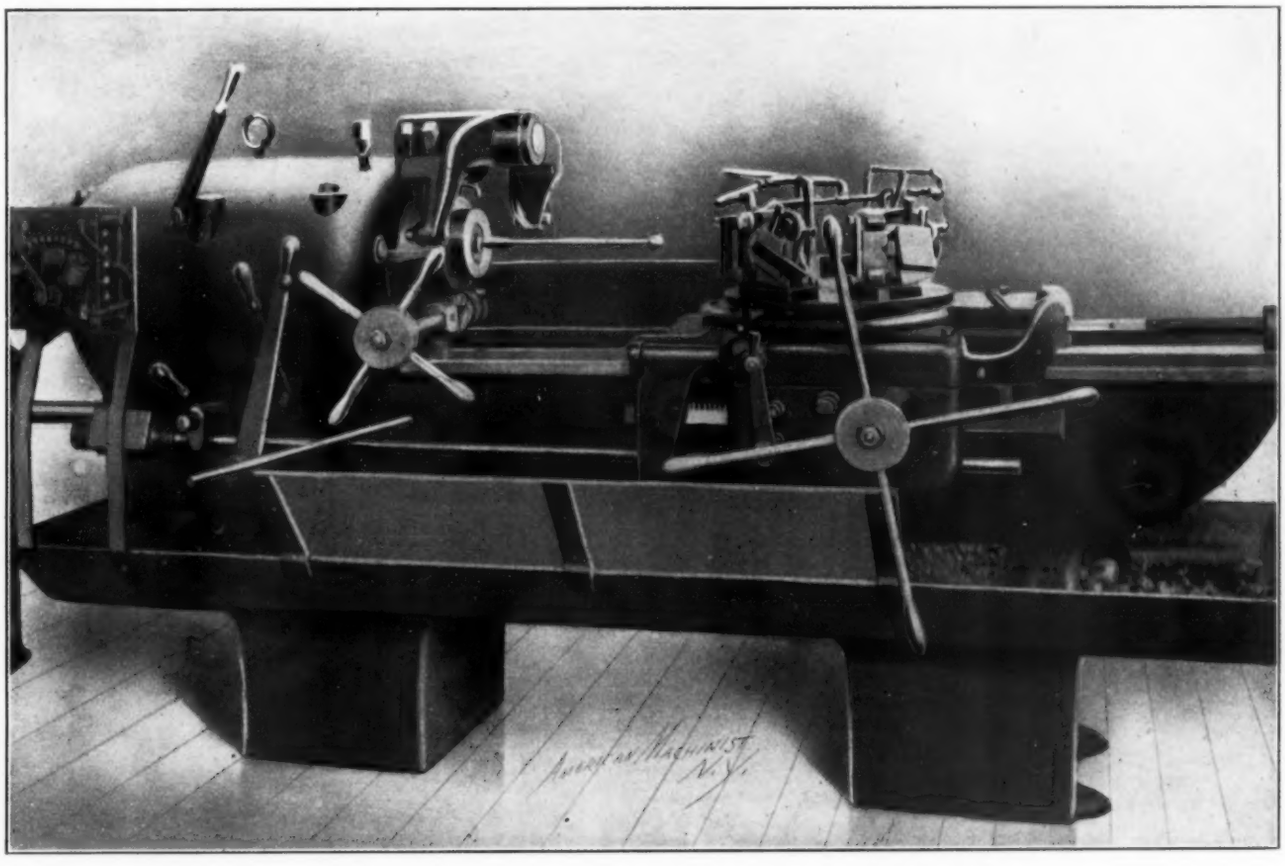


FIG. 10. 2½ X 25-INCH MACHINE WITH GEAR-DRIVEN HEAD AND FEED.

self-alining boxes for the different shafts of the same design later adopted for the cross-feeding head. The entire mechanism leading up to the spindle gear is mounted in a casting which is fitted into and bolted to the end of the head, thus making it possible to get at the inside of the gearing conveniently at any time.

The feed drive is transmitted to disks *s* by male *t*, which is carried by a swinging bracket, and driven by gear *m*, the perifery of the disk having teeth intermeshing with those on the latter. The feed rod is in this machine provided for the first time with the right- and left-hand worms and with the ingenious device which feeds the slide dead up to a stop and holds it there until released by the operator. The twelve carriage stops applied to the preceding machine are of course retained in this design; and the oscillating arm for forming and cut-off tools also is used here.

In connection with speed variators, the gear box shown in Figs. 18 and 19 should be of interest, this having been constructed to go on any 2x24 head without calling for much alteration in the machine; in fact, about the only change necessary in order to apply this box was to remove the cone pulley from the spindle and slip on a special sleeve or quill with a gear at one end to receive the power from the speed box, and a pinion at the other end to take the place of the one removed with the cone. The back-gear and triple-gear mechanism was not disturbed at all. This device was gotten out in 1903 and applied to a number of flat turret lathes.

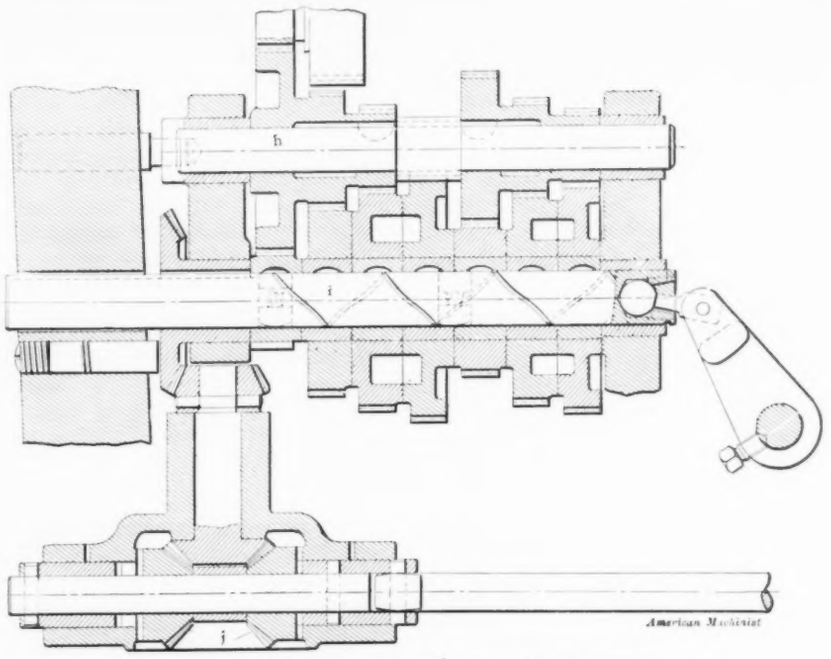


FIG. 13. FEED GEAR FOR 2½ X 25-INCH MACHINE.

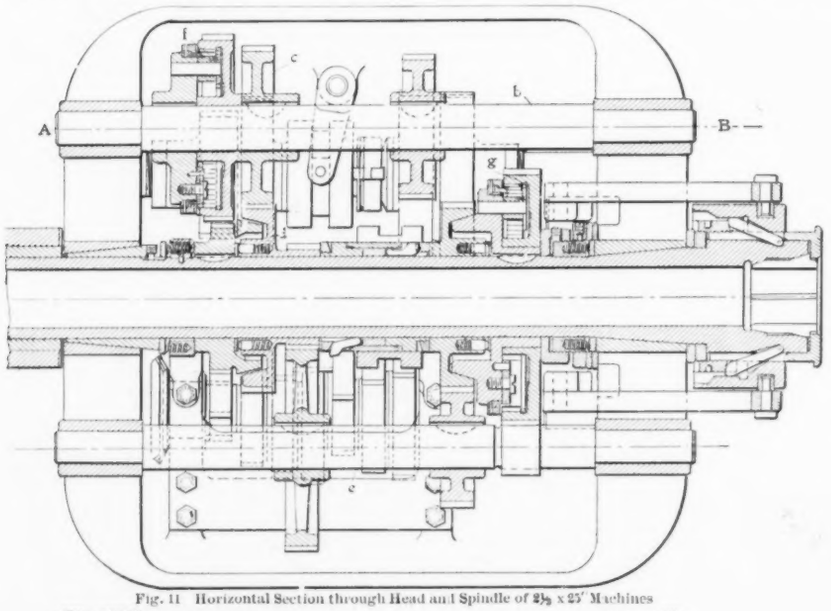


Fig. 11 Horizontal Section through Head and Spindle of 2½ x 25" Machines

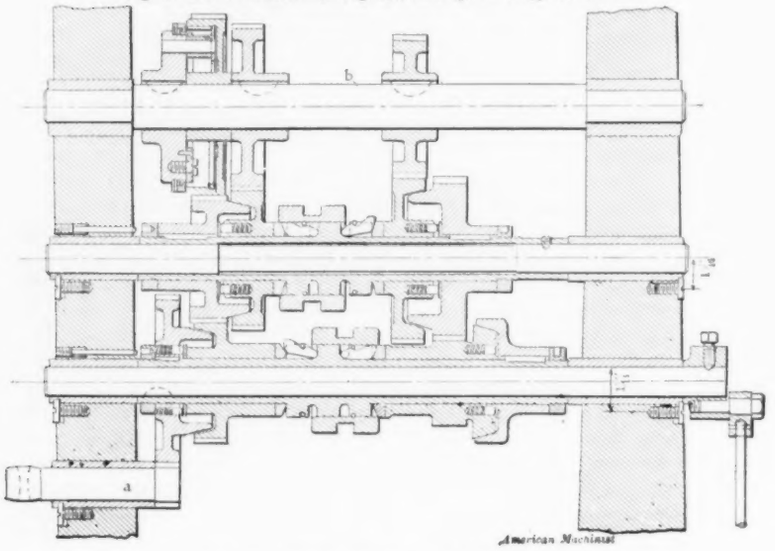


FIG. 12. SECTION ON LINE A B OF FIG. 11.

The drive may be by motor or plain countershaft belt. Shaft *a* carries the driving pulley and has, as illustrated in the sectional view, six gears, three of which are pinned fast and provided with pawls for engaging ratchet teeth formed on the other three. The gears drive six others, on shaft *b*, and from two of these are taken the forward and reverse motions for shaft *c* and for the spindle which is driven thru gear *d*. Three of the gears on *b* are pinned fast and three are pawl actuated as in the case of the lower six; and the plungers controlling the pawls in both sets of gears are so arranged that only those pawls required for a certain drive are allowed to drop into working position. The scheme gives shaft *b* six speed changes and *c* six changes in either direction. Thru the back gear and triple gears under the head the spindle has a total of eighteen speeds.

Now comes the last construction in the series preceding the new model machine with cross-feeding head. The final link connecting this masterpiece with the machine of '91 is the head illustrated in Fig. 20, and requires but the briefest mention; for, aside from the fact that it is not movable, it is in other respects precisely like its successor, having the same straight spindle with self-adjusting boxes, and enclosed speed changing gearing running in an oil

bath. The principal alterations made in designing the latest machine consist then in the cross feed added to the head, the remodeling of the bed and pan to include the ways for the head, and the mounting of the feed disks under the head and inside the pan.

It will be observed that in each of the various and briefly described steps marking the development of the machine, the characteristic features of the flat turret have been retained, as have been also the automatic chuck and the roller feed. Convenient means of control, as shown in the different engravings, have been included in each case, and each construction has embodied much of value to succeeding designs.

The machines illustrated by the halftones, and in certain cases built in considerable number, form a highly important part of the equipment of the turret lathe department at the Jones & Lamson shops; and I have yet to see a more interesting group of machinery than that formed by these same flat turret lathes as operated in that department. F. A. S.

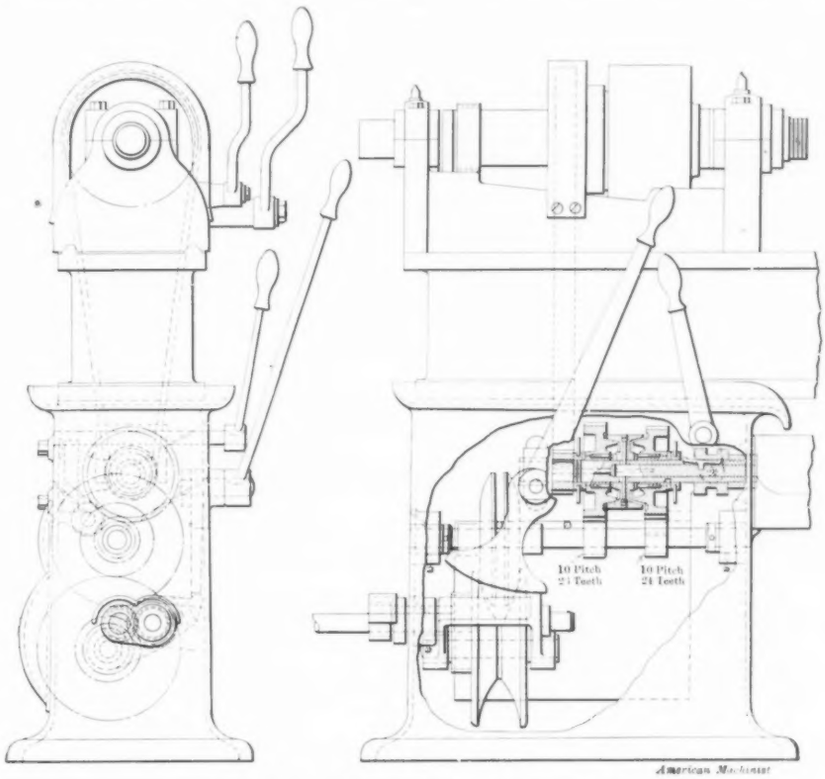


FIG. 14. DRIVE WITH HIGH-SPEED FRICTION DISKS.

Our French contemporary, *L'Automobile*, has opened a subscription for the benefit of the mechanics on the three French cars in the recent Gordon Bennett race, Muller, Lumbach and Miolans.—*The Horseless Age.*

A derailing switch in a trolley line near the writer's home "fructioned" the other morning and a car took a shoot toward the sidewalk, "derailing" two mules and an ice wagon and a baker's wagon and scattering ice and rolls over the surrounding landscape. It would seem to be bad practise to leave wagons standing in range of derailing switches.

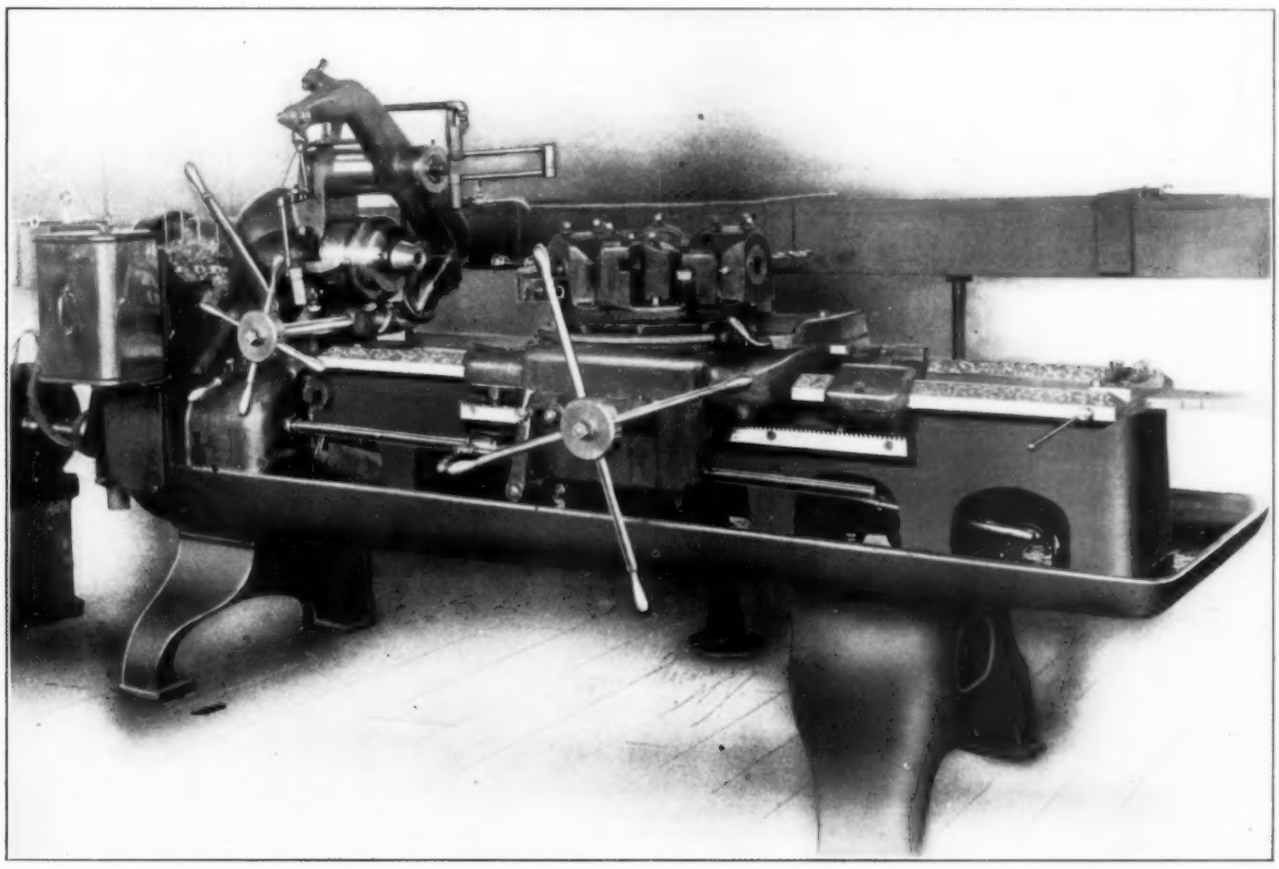


FIG. 15 2½ x 36-INCH MACHINE WITH GEAR-DRIVEN HEAD AND FRICTION FEED.

Echoes From the Oil Country—Who Are Our Judges?

I think that we all will have to agree with "Dixie" as to the value of being able to represent ideas and things by freehand drawing. This accomplishment may be very useful to mechanics who are not inventors.

There is one illustration in his interesting article, "The Value to Inventors of Being Able to Draw," that struck me forcibly, and perhaps in a way that did not appear to others. When Dixie drew his picture of a cow and had it mistaken for a "beautiful dog," he regretted that the girls had not been trained in drawing; but think of an artist whose product looked so little like the real thing that it could be mistaken in a country abounding with both dogs and cows! Evidently those girls were nice, intelligent, well-trained girls, for you see the one used the word beautiful, and she applied it to the dog and not to the picture.

I have done some freehand drawing myself, and I have had some of it very severely criticised, and as a result of my own experiences I am inclined to take the part of those foreign girls as against "Dixie," even if he is a brother mechanic.

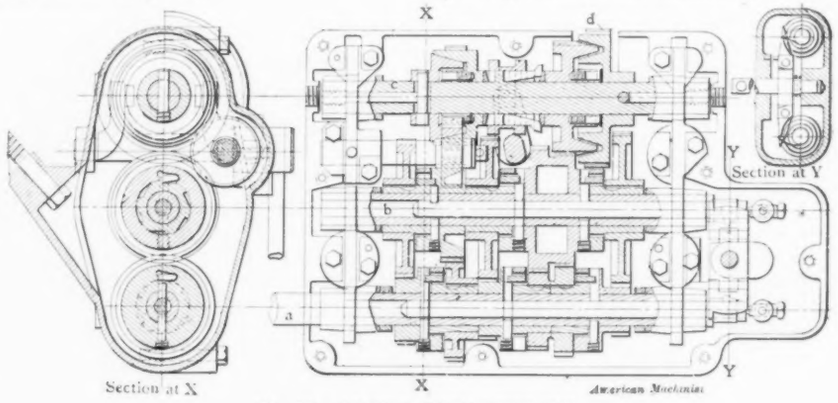


FIG. 19. SECTION THRU SPEED BOX.

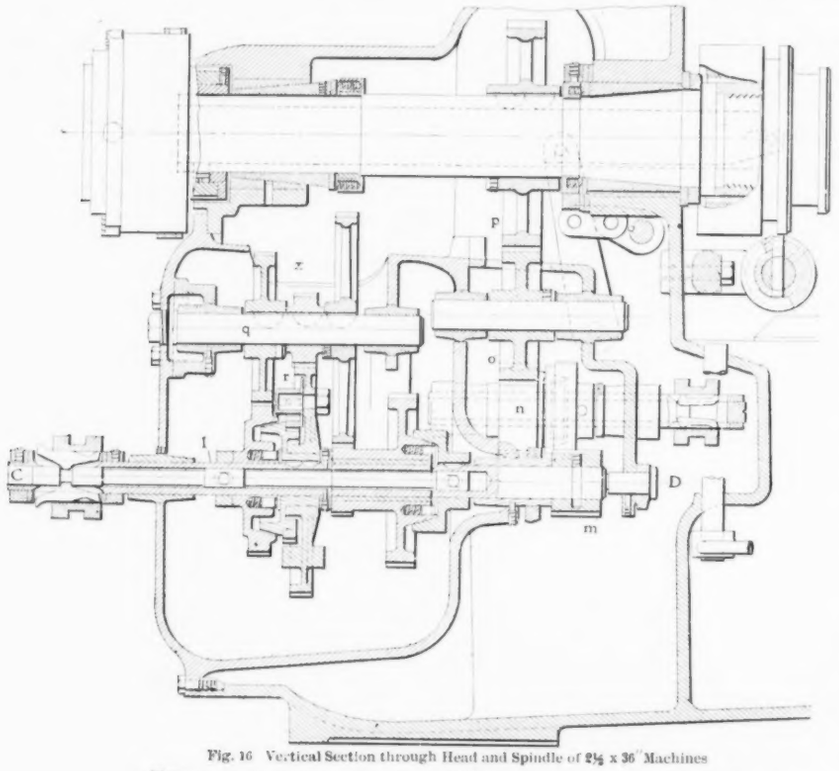


Fig. 16 Vertical Section through Head and Spindle of 24 x 36" Machines

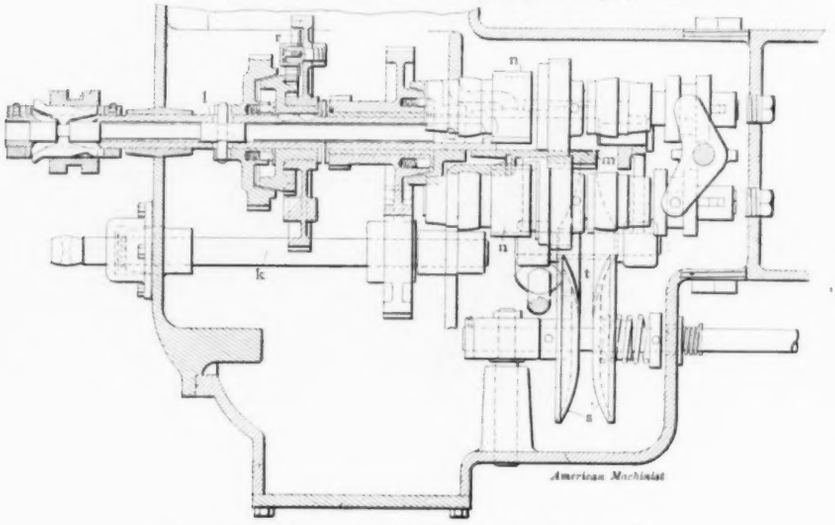


FIG. 17. PARTIAL SECTION ON LINE C D OF FIG. 16.

"Dixie" is not the only one who is blessed with children, and it has been one of my ways of amusing my babies to show them pictures and to draw pictures for them. I find that a baby of fifteen months, and who is only lisping a limited number of words, will readily recognize a good picture of anything with which it is familiar. Even when children call a cow a horse, being used to seeing horses but not seeing cows, it is often done after hesitation, and in an inquiring way that clearly shows that they see something in the picture that is not right. When I sketch the family cat sitting at ease and have it greeted by my young and honest critic with "Toadie, toadie," I begin to think that I should make more of a study of cats.

The value of freehand drawing is largely in being able to show ideas to those who are *not* versed in the art, and to do this the drawing should show the prominent characteristics of the subject being represented in a way that is unmistakable. I know that the world is full of people who will at once take issue with me in this view of the matter, but as far as my experience has gone I find that it is not the real leaders but those with a "smattering" who believe that the uneducated in their line are not competent judges.

I have very small respect for the musical ability of the so-called "eminent violinist" whose efforts before an uneducated audience were thought to be the preliminary tuning of his "fiddle."

A musician to whom I had hinted that the best test of music *as music,* was the way it was received and appreciated by sensible people who were without special musical training, came back at me with the assertion that my statement was about as sensible as it would be for me to say that the best judges of my product were those who were not mechanics. I had to admit that the very best judges of whether my machinery was any good or not, were

those who used it. As it is not meant for mechanics, and as those who use and care for it provide the conditions under which it is used, any failure on my part to provide a machine that is acceptable to them is a real failure, no matter what the machine may be as viewed from a scientific standpoint.

A very brief trial with a highly scientific machine with which it is necessary to educate people out of some of their former habits to have it succeed, will convince most people that quite a lot of efficiency can be sacrificed for the sake of having a machine fit people naturally.

There is one kind of efficiency recognized by the world of users that seems to be without a place in the scientific round of investigation. We hear and read a great deal about theoretical efficiency.

We have the importance of mechanical efficiency forcefully presented in reports of many kinds. Harder to put into shape for comparison, but of vastly more importance in all of the ordinary work of the world, and of at least equal importance in many of the big affairs, is the *fitting in* efficiency. The efficiency of my term of description may not be as high as it should be, but I mean it to describe the power a machine has to naturally fit into the surroundings where it is intended to work.

My corn sheller should be so constructed that anyone can understand how it operates to shell corn without having to have a professor in mechanics give him lessons. It should be strong enough to withstand the greatest efforts of the strongest man put forth in using it, and so simple in adjustment that the dumbest sort of man can work it without straining his intellect. This is referring to the *strongest* and the *dumbest* man who is likely to use a *corn sheller*. What does it benefit me to have several colleges certify that my machine is strictly scientific, and has a mechanical efficiency of 99 per cent. if the class of people who buy and use such machines say it is N. G.? It is very hard to overcome their verdict, and there is very little satisfaction in the thought that they are too uneducated to know a good thing when they see it. They are my market.

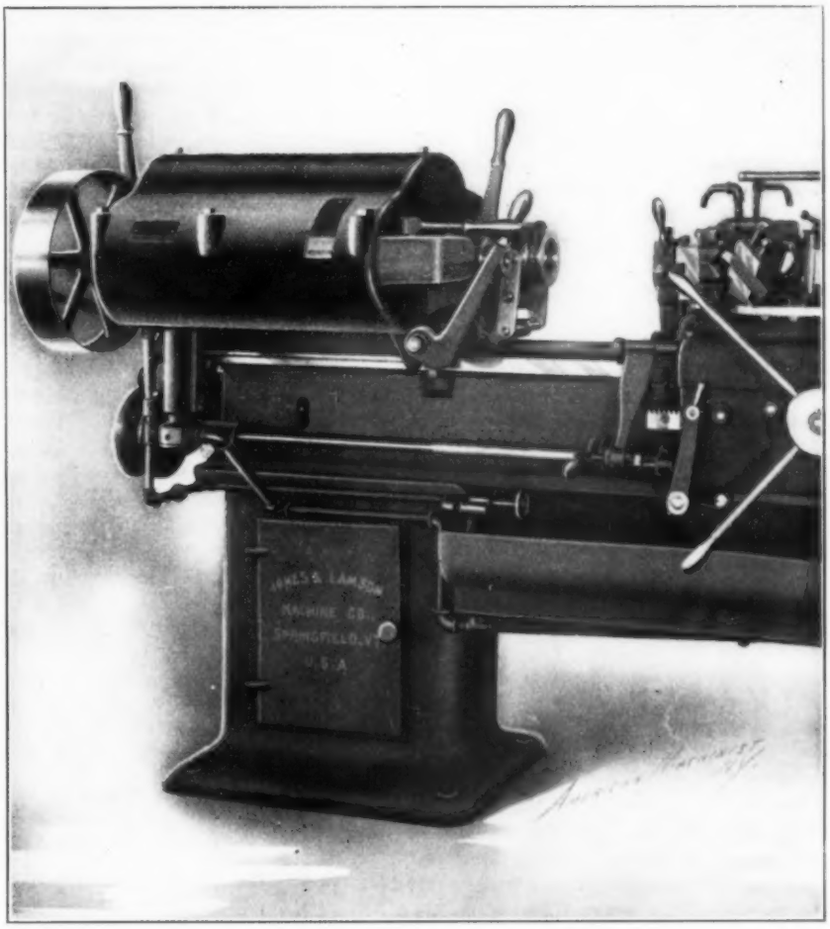


FIG. 20. HEAD IMMEDIATELY PRECEDING CROSS-FEED DESIGN.

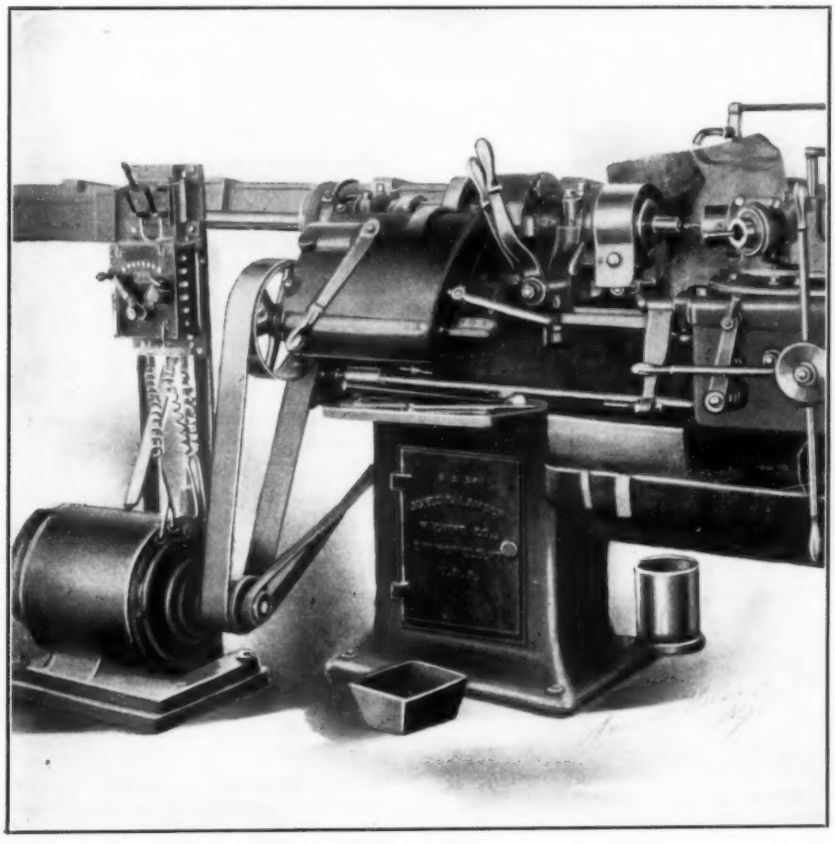


FIG. 18. SPEED BOX FOR 2 X 24.

A friend showed me some designing he had done and was reckless enough to ask for criticisms and suggestions. His trustfulness led me to disclose to him one rule that I generally keep locked up for private use. (It might hurt the feelings of users of strictly high-grade appliances if they knew such a rule was being used in designing things intended for their use.) As near as I can express it, the rule runs this way: *Always design for the dumbest man who is likely to use the class of machinery you are making.* When I use anything that seems to suit me particularly well, I think the designer followed my rule whether he knew it or not.

The world wants pictures that speak for themselves without having to have an in-

terpreter. It wants machines that will keep going with the least amount of thought on the part of the user, and the man who thinks he can do a big business supplying the world with things it don't want will find he has picked a very hard way to make a fortune if he goes beyond the thinking stage, and it will not take him long to find out that the world will take the machine that is the easiest to understand, and to keep going.

There was once an injector made that was said to be a wonder for efficiency. There were three handles used in starting it, and if I remember rightly, one of them had to be used twice. A man who was in a hurry generally forgot how these handles had to be set to begin with in starting and the order and amount of opening needed. The result was that they gave considerable trouble in starting, altho it was a very reliable injector and gave very good results after a man had learned his lesson so well that he did not get mixed on the combination. By and by there came another injector into the field and it was the one the men all seemed to want, and very often they got it, too. Whenever there was trouble with the first one the cure recommended was to put in one of the second kind.

I never heard anything of the efficiency of this last one. If it had any efficiency it seemed to have been overlooked by the manufacturers, and was not called for by the users, and yet it was supplanting one of undoubted merit. To understand how it was able to do this it was only necessary to read the directions for operating: "To start—Turn on the steam. To stop—Turn off the steam." Even the dumbest man who would be apt to try to start it couldn't get far astray, for even if he did not know which way to turn for off and for on he would turn the way he found that the handle would go. It looks as tho the telephone people had been sort of forced to the place where this rule naturally leads, as to use the latest 'phones in this section it is necessary only to take off the receiver and place it to the ear to begin and to hang it back on the hook when thru.

Very few people will object because things are made easy for them, and really, in this day and age when we all acknowledge the value of brain work, is it to be wondered at that people do not like things that call for any unneeded mental effort on their part when the same end can be reached without it? W. OSBORNE.

Always drill an air hole in a tube which you propose to close up by brazing, but never put spelter and borax inside such a tube if it is possible to braze a good joint from the outside, because some of the flux scale is sure to remain inside the tube, and rattle—to the rider's subsequent annoyance.

Low's Diagram Measurer.*

A variety of devices have been designed with the object of rapidly estimating the area of irregular-shaped diagrams, or, what is practically the same thing in the case of indicator diagrams, of determining the average width of a conventional number of strips into which it may be divided, with the object of arriving at the mean average pressure in the engine cylinder during a stroke of the piston. As a rule, mechanical measuring instruments or planimeters are costly, and hence not so widely used as they otherwise would be for this purpose. With a view to overcome this objection and to meet a certain want, Prof. D. A. Low, of the East London Technical College, has devised a little transparent measuring scale which we have pleasure in illustrating herewith, and which is being put on the market by Messrs. Longman at the modest price of one shilling.

The theory of the instrument is based on the fact that if $A\,B\,C\,D$, Fig. 1, is a rectilineal figure in which $A\,D$ is parallel to $B\,C$, $E\,F$ is parallel to $A\,D$ and $B\,C$, and midway between them, and $H\,K$ is perpendicular to $E\,F$, it is easy to show that the area of $A\,B\,C\,D$ is equal to $e\,f \times h\,k$. Fig. 2 differs from Fig. 1 only in that

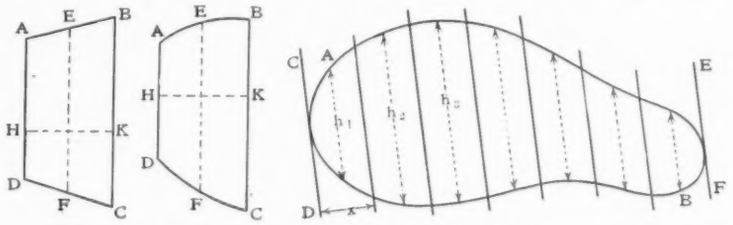


FIG. 1 FIG. 2 FIG. 3 *American Machinist*

THE PRINCIPLE OF THE DIAGRAM MEASURER.

$A\,E\,B$ and $C\,F\,D$ are curved instead of straight lines. In this case the area of the figure is approximately equal to $e\,f \times h\,k$.

$A\,B$, Fig. 3, is a figure lying between two parallel lines $C\,D$ and $E\,F$, and the figure is divided into strips of equal width by lines parallel to $C\,D$. The dotted lines h_1, h_2, h_3, etc., are parallel to $C\,D$, and lie in the middle of the width of the strips. The area of the figure is obviously approximately equal to $h_1\,x + h_2\,x + h_3\,x +$ etc. . . . or to $(h_1 + h_2 + h_3 +$ etc. . . .) $\times\, x$. If $x = 1$ inch, then the area of the figure in square inches is simply the sum of the lengths h_1, h_2, h_3, etc., in inches. If $x = \frac{1}{2}$ inch, then the area of $A\,B$ is the sum of the lengths h_1, h_2, h_3, etc., measured with a scale equal to twice full size. In the instrument described below the distance x is $\frac{1}{5}$ inch, and therefore the lengths h_1, h_2, h_3, etc., must be measured with a scale five times full size, or a length of 5 inches will represent an area of 1 square inch.

Professor Low's device consists of a piece of clear transparent celluloid 6½ inches long and 3 inches wide, upon which is printed from a specially engraved block a series of equidistant longitudinal lines intersected at right angles by a series of equidistant transverse lines, as shown in Figs. 4, 5, 6 and 7, which show the instrument to a reduced scale. The thin longitudinal lines are exactly ⅕ inch apart, and when the instrument is placed over the diagram, in the manner explained below, these thin lines divide the diagram into thirteen parallel strips of equal width. The thicker longitudinal lines lie in the middle of the width of the strips and the portions of their lengths lying within the diagram, measured by the scale on the left, give the areas of the strips in square inches. The scale to the right is a scale of inches, full size, and is used in measuring the length of a diagram.

In using the instrument the celluloid is placed on top of the diagram to be measured so that the diagram lies entirely between, and is touched by, the two outside longitudinal lines, as shown in Fig. 4, a straight-edge being placed in the position shown. Holding the straight-edge with the left hand, the instrument is slid with the right hand until the lower end of the ordinate No. 1 is on the lower part of the boundary line of the diagram, as shown in Fig. 5. It will be observed that in the example illustrated, the No. 1 ordinate cuts the boundary line of the diagram again at the point .15. The area of the first strip of the diagram is therefore .15 square inch area. The point of a needle, held in the right hand, is now placed at the point .15 on the ordinate No. 2, and, still holding the straight-edge with the left hand, the instrument is slid downward until the needle point is on the lower part of the boundary line of the diagram, as shown in Fig. 6. It will be seen that ordinate No. 2 cuts the boundary line of the diagram again at the point .42. The combined area of the two strips of the diagram is therefore .42 square inch. The point of the needle is next placed at a point .42 on ordinate No. 3, and the instrument is slid downward as before until the needle point is again on the boundary line of the diagram, and so on. The number of strips which can be measured in this way will be limited by the length of the instrument and the size of the diagram. In the example chosen it is found that the sum of the areas of the first four strips is 1.06, and the instrument is not long enough to add on the area of the fifth strip. Make a note of the area of the first four strips, viz.: 1.06, and,

* From the *Mechanical Engineer*.

still keeping the straight-edge in the same position, slide the instrument upward until the lower end of the ordinate No. 5 is on the lower part of the boundary line of the diagram, and, proceeding as before, add up the areas of the fifth, sixth and seventh strips. These are found to come to .94, and this number is noted down under the 1.06 already noted.

Next slide the instrument upward against the straight-edge until the lower end of ordinate No. 8 is on the lower part of the boundary line of the diagram. Proceeding as before, it is found that in this case the instrument is long enough to add up the areas of the remaining six strips, the sum of these areas being .93. This area is noted down under those previously noted, and the sum stands thus: 1.06, .94, .93, showing that the total area of the diagram is 2.93 square inches.

If the diagram is an indicator diagram, its extreme length parallel to the atmospheric line is measured as shown in Fig. 7, the instrument being placed on the diagram so that one of the longitudinal lines is on the atmospheric line. The length in this case is seen to be 3.35 inches. The mean hight of the diagram, measured perpendicular to the atmospheric line, is therefore $\frac{2.93}{3.35}$ inch, and this multiplied by the scale of the indicator spring, in this case 30 pounds per inch, gives the mean effective pressure as $\frac{2.93 \times 30}{3.35} = 26.2$ pounds per square inch.

The instrument is wide enough to take in any ordinary indicator diagram, but it may be used for measuring diagrams which are too large to be placed within the width of the instrument, if the diagram be divided into two or more parts and the areas of the parts measured separately. If a diagram is not large enough to stretch across the whole width of the instrument, a portion only of the width may be used, and the diagram will then be divided into less than thirteen strips.

With very little practise the mean effective pressure from an indicator diagram can be determined with this instrument almost as quickly as with an expensive planimeter, and with sufficient accuracy for all practical purposes.

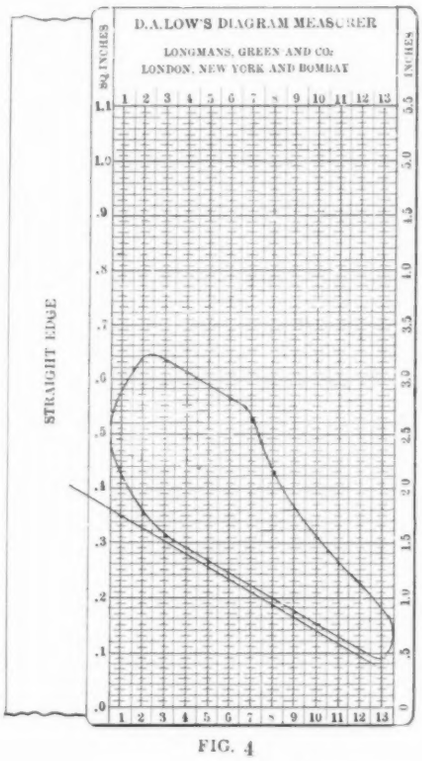


FIG. 4

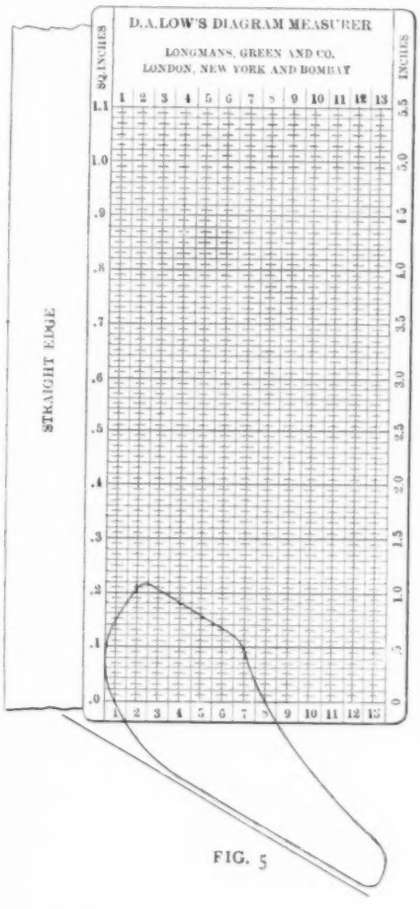


FIG. 5

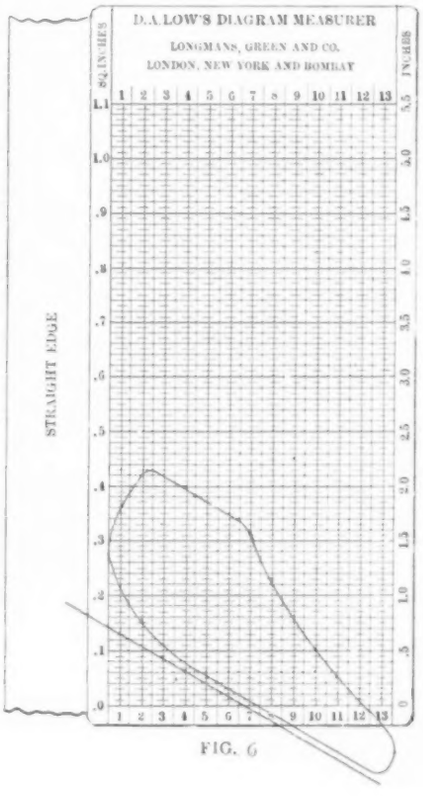


FIG. 6

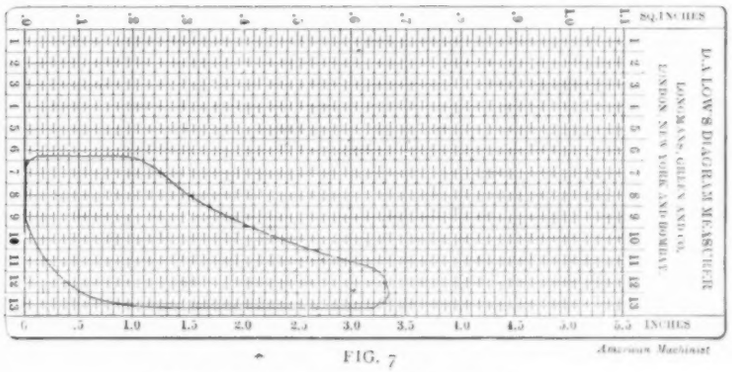


FIG. 7

THE USE OF THE DIAGRAM MEASURER.

A German Piece-Work Man in Italy.*

We must learn from the Americans to esteem and honor the help of the workmen in improving methods, since they are the men who have the greatest practical experience. The generally prevalent practise in Europe of reducing the piece-work rate when a man exceeds a certain wage per hour is one of the greatest faults of our industrial conditions, for this custom is narrow-minded and short-sighted. Firstly, it retards the movements of the workman, and, secondly, it deprives him of incentive to think of improvements in working methods, since "he gets nothing out of them." I speak from my own practical knowledge of these conditions, since between school and university study, I stood six years at the vise and lathe. I might from that period adduce an example.

After a three years' experience in a fine mechanical shop of my northern home, up on the Sound, I arrived at Florence, where I had secured by letter a place in a respectable factory. At my entrance there was thrust into my hand a *Regolamento*, a rule-book of thirty-nine closely printed pages, with numberless paragraphs. My knowledge of the Italian language was limited to ten words, by count; nevertheless I set myself to work evenings and endeavored, with the help of the dictionary, to draw some information out of the *Regolamento*. The first word that I learned was *multa*—penalty, fine. It repeated itself in paragraph after paragraph, unnumbered times, and seemed to dominate the entire contents. I did not understand much of it, but I got this out of it, that the *Regolamento* prescribed a money fine—25 centissimo (5 cents), 40 ctso., 50 ctso., 60 ctso., 75 ctso., 1 lira, etc.—for every imaginable and possible offence, and truly with astonishing detail and adjustment according to the degree of the fault. Since it was impossible to me, because of my deficient knowledge of the language, to understand the fine distinctions, I soon left off my study—long before I had come to page 18—and so I did not learn what was there set forth: "That the piece-workman might earn only 25 per cent. above his fixed hourly wage; if a higher sum resulted, the surplus would be deducted." After a few weeks I received my "first contract." These words betoken for the young workman about the same feelings as does to a young fox of a German student corps his first duel. Now he is to show what he has learned and what he can do. Now for the first time he can measure his powers and efficiency with those of others. Happy in the joy of accomplishment, I went to the work. It was a small contract—the amount was 32 lire—and in four days the work was ready and was taken from me without hesitation. In the accounting I was awarded, instead of 32 lire, only 17 lire 50 ctso.—14 lire wages and 3.50 lire (= 25 per cent.) extra—and when I inquired into the cause I was confronted with that paragraph on page 18. Then I protested, first to the foreman, to whom, since he hardly understood French, I tried to make my objections intelligible partly in Latin; afterward to the chief engineer and finally to the manager. I wanted the payment that the foreman had orally promised me, and further, for the future, a written evidence of the contract price. The result was that a printed contract form was produced, on the back side of which was that ominous 25-per-cent. paragraph, and I was privately promised that this paragraph should not in the future be applied to me; in the previous case, however, I must be content with the 17.50 lire. Shortly thereafter I received a new and larger piece job. In a consciousness of the results in view I worked with activity and new joy, till I learned that the recompense that had been provided for me was about 40 per cent. less than the contract rate that had been paid for years previous. This brought my joy in working to an end—and a few weeks later I found another place in Rome.

No one who has not gone thru it himself can comprehend the laming and depressing effect of such an experience of small-heartedness and short-sightedness upon pleasure in labor and the rapidity of a workman. It makes little difference whether a reduction of the contract rate, such as that in the Florence shop, is done at once, or later thru a new award of the same contract, as is usually the case. In many factories it is customary, so soon as a piece workman exceeds by more than 50 per cent. his assigned hourly wage, thenceforth correspondingly to reduce the contract rate. Here another psychological moment leads to the same result: it is the rapid, adept workman that depresses the price. He himself receives directly full compensation, but those who come after him get less. They turn against him and make the bitterest complaint because he has "destroyed the rate" and fling at him the accusation of deficient fellowship, etc. The tone with which the term "rate depressor" is uttered is expressive enough—it sounds very much like "Traitor!" And therefore the prevalent system of immediate rate reduction has such a retarding and depressing effect on the most able and rapid workmen.

Quite differently would affairs work out if the piece rate were in general firmly adhered to and revised from year to year with a rule that the separate rates should then be reduced only when *on an average* during the past year they exceeded by more than 50 per cent. the hour wage of the workman concerned; and that in such case the surplus should be reduced by only one-half. With such an arrangement the complaints against the skillful workman on the part of his comrades would disappear, since, when at the end of the year a rate is cut, no one in particular is to blame but the reduction depends on the average production of many, and there remains an incentive for each workman to increase his earnings by rapid work.

That the employer, in spite of this somewhat slow reduction of the rate, will secure his return cannot be doubted by one who understands the circumstances; for the employer takes into account not only the wages, but must have the equipment operated with the greatest possible intensity, and this feature becomes increasingly important compared with the wage factor as mechanical art develops and more expensive machinery is used. . . .

Another method of enlisting the active co-operation of employees is to give them special compensation for improvements in working methods. The inventive faculty is spontaneous and cannot properly be paid for by a stated wage, but only when it produces results, and in proportion to them. A suitable remuneration seems to me to be one-third of the value that the improvement bears; in the case of patented inventions during the life of the patent, and for unprotected ones from three to five years. In this manner the benefits of patent legislation would reach the employee class. At present the workman is excluded from its advantages, since his invention may be claimed by his employer. This proposition may meet with sharp dissent, but I think that its utility will be appreciated when there is a better understanding of industrial conditions in America.

*Translated with some condensation from Jul. H. West's "Hie Europa! Hie Amerika!" by E. P. Buffet.

Training Subordinates for Promotion.

We take the following from a paper by S. W. Miller before the International Railway Master Boiler Makers:

"Organization demands that we have somebody to succeed us. Have you in your shop men working for you who are competent to take your place if you are called away, if you should be transferred to some other place? Possibly this has occurred to you; possibly not. I want to urge upon you very strongly the educating of the men under you—the men who are doing the work for you—the men who are making you a success. It is coming to be more and more recognized every day by those in charge of the education of children that it must begin when the child is young. The same thing applies to the men working in the shops. We must not only select those who appear to be bright and sharp, but we must make especial effort to increase the efficiency of our brothers by educating them in every possible way. In olden times the foreman would not give up to anybody what he called his trade secrets. It was a mistaken policy—very mistaken. The man who makes a success does it not by doing himself all the work, but by having those who are subordinates do the work for him."

Letters From Practical Men.

The Oval Lathe and the Relief of Taps.

Editor American Machinist:

Your illustration and description of Mr. Menders' oval lathe, at page 936, brings to mind a lathe invented and patented some thirty or forty years ago and which was used for a number of years in making oval picture frames which were the fashion at that time.

The elliptical motion was given to the face-plate by two shafts, one within the other—the inner one rotating at twice the speed of the other and having on its end an eccentric whose throw was one-half the difference between the major and minor diameters of the oval required.

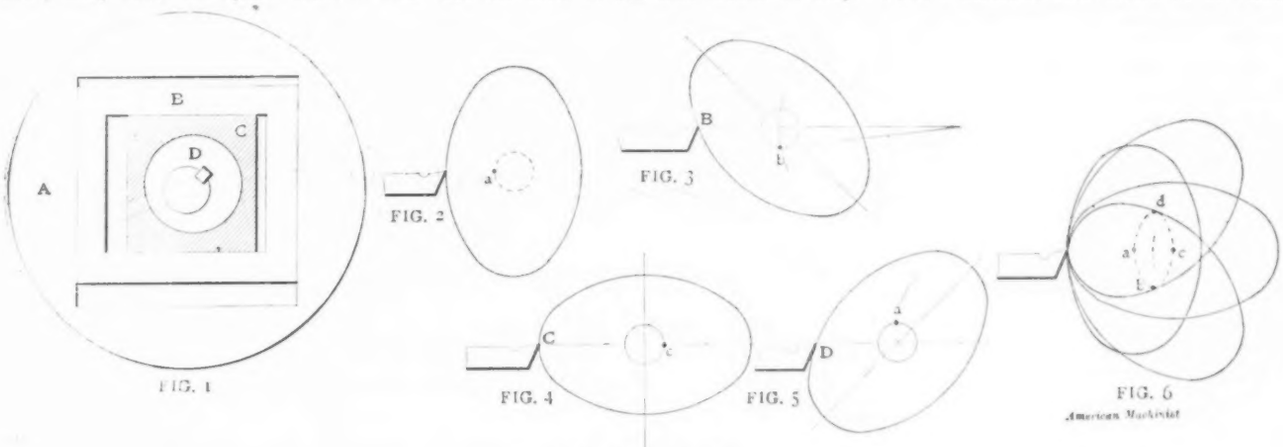
Fig. 1 gives a general idea of the essential part of the invention. The face-plate *A*, fixed to the outer shaft, had a square recess within which a rectangular frame *B* was free to slide in one direction and within the frame *B*, a square block *C* was free to slide in a direction at right angles to the first; thus, while the square block *C* was compelled to rotate with the plate *A*, it was free to slide upon it in any direction. Within this block worked the eccentric *D*, which could be changed for others of more or less eccentricity. To the square block *C* was secured to, or it was in fact a part of, the face-plate upon which the work to be machined was secured.

Just why this arrangement produces an ellipse is not either easy to understand or describe, but by referring to Figs. 2, 3, 4 and 5 it will be understood by most mechanics and others can take my word for it.

When the tool was cutting at the point *A*, Fig. 2, the center of the eccentric was at *a*. When the piece had rotated one-eighth of a turn and the tool cutting at *B*, Fig. 3, the eccentric had made one-fourth of a turn and was at *b*. When a quarter of a turn of the piece was reached as in Fig. 4, the eccentric had made a half turn and was at *c* and the tool cutting at *c*, and so on as shown in Fig. 5.

It will be noticed that the tool is not tangent to the cut nor is it in Mr. Menders' or the other oval lathes. In this arrangement it would be if the main shaft was given a curved motion up and down a distance about as great as the throw of the central eccentric and about as shown by dotted line Fig. 6. It will be seen that the centers *d* and *b* are about twice as far above and below the center line, as in Figs. 3 and 5, and a little farther away from the point of the tool than if moved up and down in a vertical line. All this, however, is only a prelude to the suggestion for a better method of relieving taps, milling cutters, etc. As shown in the original patent it is necessary only to give the inner shaft the required speed in proportion to the outer one, to produce any number of lobes on the piece turned.

If the tail center of a lathe were to be made very slightly eccentric and caused to revolve four times while the main spindle rotates once and used to thread taps, and the flutes located in the right position, the taps would not only have a clearance but the right sort of clearance—that is to say, the cutting edge would be relieved, but the back of the land would be only slightly smaller than the cutting edge so that when backing out the tap the chips would not wedge in.



THE OVAL LATHE.

The first idea was to have both centers eccentric and revolve in unison, giving the same clearance at the upper end of the thread as at the point, but I do not think that necessary. The point or starting end of the tap does the bulk of the cutting and needs both the most clearance and the most chip room.

Since the Copenhagen mechanic, Mr. Holm, asked me why our twist-drill makers flute twist drills deepest at the point, and taps par..llel, I keep asking myself the same question without being able to find a reply. Is it because the makers fear it will cost too much to sell them, or is it too much bother to jack up the centers on the milling machines so as to cut them taper?

To relieve reamers and milling cutters, it only requires that the eccentric tail center be revolved as many times to the main spindle single rotation as there are teeth in the tool, and that the eccentricity of the centers be very slight. In the case of a cutter of many teeth, this would mean pretty fast, but it is much easier to rotate the tail spindle than to jigger a slide-rest or tool back and forth, and besides the tool is twice as near tangent to the surface as it is when the tool is reciprocated.

JOHN E. SWEET.

A Lathe Tool Suggestion.

Editor American Machinist:

Holding our lathe tools horizontally while the work is being done vertically across the end seems neither philosophical nor economical. It requires the tool to be extra heavy to prevent its breaking off, calls for forging that is liable to injure the steel, and necessitates throwing away a fine chunk of steel when it gets too short for the tool-post.

It would seem better to hold the tool vertically where the nature of the work will permit of it, its upper end leaning toward the work.

Such tools could then be of lesser thickness and of the shape throughout that is now given at the end by the blacksmith. Thus a diamond tool would be so rolled by the steelmaker and fit closely its whole length, except the short protrusion at the top, into a steel vise-like matrix capable of an intense grip.

If the grip be insufficient, a wedge with a screw behind it could be devised and placed beneath to give a positive end thrust and to raise it as it wears shorter; and when the wedge reaches its limit short pieces of steel could be put under the end of the tool from time to time.

This would permit of using up a long piece of steel as closely as can now be done with short pieces in the ordinary tool holders; but these are wasteful because they require the steel to be reduced to small pieces, a part of each of which must be thrown away when too short for further use.

Redesigning of lathes for the end thrust tools would not be necessary. The new tool holder might be hung at the side of the cross-slide, with a sleeve fitting over the ordinary tool-post by which it would be secured in place as we now tighten the tool. Or it might have an arm sliding

into the groove under the tool-post and tightened by a screw and washer. A little experimenting would probably make the idea practicable. J. F. HARTMANN.

Making an Armature Segment Templet.

Editor American Machinist:

At page 797, A. B. C. opens up a very interesting and important subject which can stand much further comment.

In the making of armature segment templets a little money spent at the start will prove a source of great saving when it comes to handling the thousands of punchings when assembling the machines; therefore I will describe in detail how a very up-to-date electric concern goes at it.

The placing of the dovetails is one of the esentials points, but the location of the slots is equally important, as when assembling the punchings in the machine in any way the slots must line up. The method I am about to describe of making these templets is based on a system of reversing on six accurately located pin-holes, and not filing to any lines but working entirely to a gage and plain external measurements. The pins for the six holes are 3-16 inch diameter, about 1 inch long, hardened, ground and lapped, and all exactly the same size. The end driven into the templet is perfectly flat, with only the extreme corner taken off with an oilstone: the other end is beveled off to about 3-16 inch diameter, so that, when driving, a slightly slanting blow will not drive the pin in crooked.

I am now ready to describe the method, and will use the templet shown in Fig. 1 for reference; it is to have 36 slots and 12 segments complete the circle.

For the templets, of which we will make two—an original and a duplicate—we will take ⅛-inch sheet brass, which we will hammer flat on a plate with a mallet. Then we will lay the two pieces one on top of the other, and in some out-of-the-way place near each end, as *a* and *b* in the sketch, we drill two 3-16 inch holes for two rivets. We now rivet the plates together and with a bandsaw saw out approximately the radius and dovetails so as to relieve some of the strains before we put any accuracy into the templets.

Now they are put on the radial planer and the outside edge planed and the inside marked to correct radius by taking a sharp-pointed side tool and running in about 1-32 inch, with the square side toward the templet; this groove is used as a gage to which it is easy to file the inside. As the templet is now planed we must next determine the center distances of the dovetails *A B*, which is the most essential step and the basis of the whole templet.

About the place we want to locate the dovetail at *A* we drill and ream a 3-16 inch hole as shown. The location of this hole is not particular, only it must be a straight, smooth hole thru both templets. Into this hole drive one of the six pins spoken of before.

Now measure the distance from the outside planed edge to the center of the pin, which can be done accurately, and subtract this from the outside radius; figure the chord of an arc of that radius having 12 segments to the circle:

$$\text{radius} \times \text{sine of } \frac{360^\circ}{2 \times \text{number of segments}} = \tfrac{1}{2} \text{ chord.}$$

Having figured the length of the chord, add .375 = diameter of bushing of jig shown in Fig. 2 to the chord and set the jig accurately by measuring to your figures.

Next slip one end of the jig over that one pin in the templet and place the locating arm on the bushing, and adjust it so it will just touch the outer curved edge; transfer the arm to the other bushing and locate the jig and clamp. Now drill and ream the pin hole at *B*. Since the templet depends on these two pins as centers, there is no chance for any errors in the center distance of the resulting dovetails. Drill another pin hole somewhere near the point *C* and thru both templets, and then separate the templets by driving out the two rivets. We have now drilled three holes without laying out; for

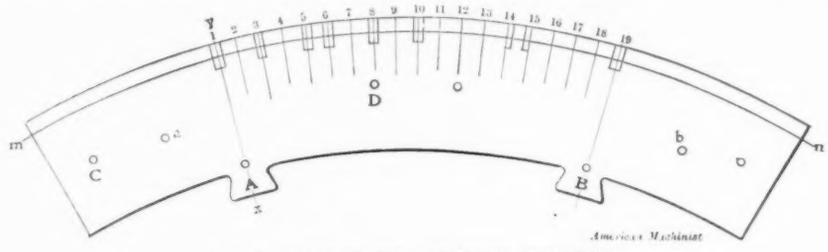


FIG. 1. TEMPLET FOR ARMATURE SEGMENTS.

locating the fourth hole, *D*, we reverse the duplicate templet on the line *x y* and drive in the pin on the dovetail, then line up the planed edge with a square to shut out light, clamp the templets and drill thru the original, using the drilled hole in the duplicate as a jig, and *vice versa*.

Now we have the three pins *A*, *C*, *D*, so reverse the duplicate, bringing dovetail *A* under dovetail *B* of the original, and using the drilled holes in each templet for a jig drill thru the other templet.

We now have all six holes drilled, the last four in correct relation to the two accurately located dovetail pin holes, which we distanced by measuring-machine measurement; therefore we have the foundation for an accurate templet, as the rest of the templet is derived by reversing on the six pins.

Now upon the original we will lay out the dovetails and slots approximately, which is not difficult. Place a center square on the outer edge, put a half-pin in the dovetail pin hole, place the blade of the center square against this, draw the radial line *x y*, and from this line proceed with the laying out. The next step is to drill and counterbore out the stock in the slots, after having again pinned the two templets together. There is not much danger of springing the templet by removing this stock, as a rib, not shown in the sketch, is left intact at the upper end.

A counterbore 1-64 inch small is plenty small enough, as with a little care in laying out, the slots will not be out that much.

For filing the slots and dovetails, so as to insure their being perfectly straight and square, we use the filing jig Fig. 3. This needs no explanation, except that the two screws *E* and *F*, against which the outer edge of the work rests are adjusted so that the hardened steel plates on the jig will always take a position which will make the sides of the slots parallel.

Before filing place the original templet on top of the duplicate and drive in the two dovetail pins; and in order to make it firmer drive in two more pins in any of the other holes. Next place the jig with the hardened plates on one side of the slot which is on the radial line with the dovetail (slot No. 1, Fig. 1). Use the laying out again only as an approximation, and, to allow for errors, place the jig about 0.010 inch from the line representing the edge of the slot; then clamp the jig by tightening the screw *G* passing thru the jaws, file the slot down to the hardened plates on the jig and then remove the latter.

Now drive out the pins and reverse the duplicate on the line *x y*, which will bring our filed side of the duplicate under the unfiled side of the original, and *vise versa*. Now by means of a straight-edge set the filing jig even with the filed surface and file thru the other templet; then with a micrometer and inside caliper obtain the width of the slot now filed. If it measures 0.010 inch too small, place the filing jig on again, and with a 0.005 inch thickness gage and a straight-edge set the jig to take off 0.005 inch, and then bring the templets back to their original position and file out the other side, using the surface just filed on one templet as a gage for setting the jig. Now this slot is right up to plug size and reversible. In just exactly the same way as we located this slot we file the dovetail, only we have a dovetail gage instead of working to measurements. Now we have one slot and one dovetail complete on both templets; by simply reversing the duplicate we can bring that finished slot and dovetail under the unfinished slot and dovetail of the original, and, using the former as a guide

to set the filing jig to, we finish that dovetail and slot. Now we have two slots and both dovetails finished and exactly reversible and all center distances correct.

Next comes the spacing of the slots: Since the templet has eighteen slots between the dovetails, then there is one slot just halfway between the two dovetail slots. This slot is numbered 10 on the sketch, and it is a simple matter to get it exactly in the center by simply using the reversing method just described. Now we have two dovetail slots and this central slot in both templets complete. There is no slot central between No. 10 and No. 1, but we find there is a rib; the trick is to get this rib just the right thickness so the rest of the slots will divide up evenly. To do this proceed as follows:

With a scratch-gage and the planed surface as a guide draw an arc 1 inch from the planed surface clear across the templet, as shown at *m n*. Subtract this 1 inch from the outside radius and figure the width of the rib at its intersection with this line.

It is plenty close enough to figure the chord between the centers of two slots and subtract the width of the slot; the remainder equals the thickness of the rib at the intersection of the line *m n*.

Make a little snap-gage of a piece of sheet metal exactly this figured size and file the rib by the reversing method described before, only instead of reversing on pins, use two flat plugs in slots 1 and 10 and a pair of parallel clamps. The rib can be filed very accurately to size, as it has a slight taper, generally about .008 to the inch; so if the gage slides to within ⅛ inch of the arc there is 0.001 inch to come off the rib yet.

When the rib has the right thickness and is reversible we finish the other side of the slot by placing our filing jig just the right distance away to make the slot the right size.

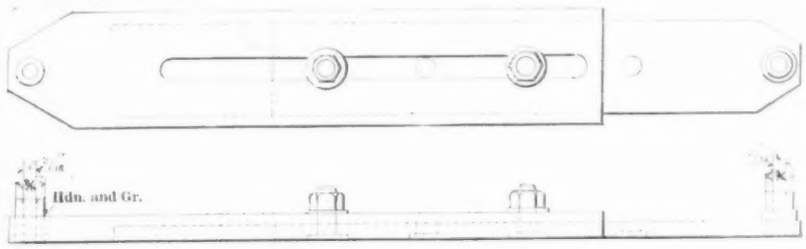
We have now slots 5 and 6 finished: upon investigation we find that between slots 1 and 5 is a central slot, 3; we get this slot central by reversing, using our flat plugs in holes 1 and 5. Slot No. 8 we get in the same way. For slots 2, 4, 7 and 9 we use our little sheet-metal snap-gage again.

The slots from 1 to 10 are now finished and correct, and by reversing these ten slots into different positions and using them as gages to set the jig to, we file the incompleted slots.

A templet made in this manner is accurate in every detail, can be reversed, and slots can be shifted in any way, and there will be no greater error than 0.001 inch anywhere. A templet, as described above is generally completed in from forty to fifty hours.

Another advantage of duplicate templets is, the duplicate can be used in making the die, thus saving the original as a master.

A TOOLMAKER.



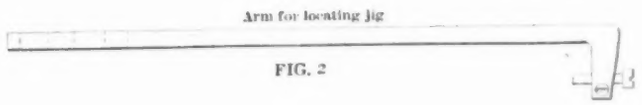


FIG. 2

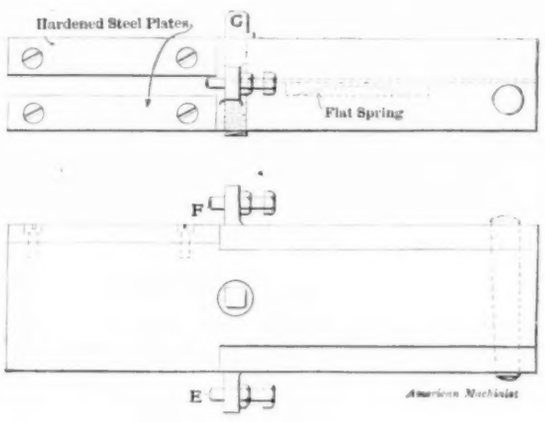


FIG. 3

DRILLING AND FILING JIGS FOR TEMPLET.

Inside Measuring Devices for Small Holes.

Editor American Machinist:

There is a tool that is much needed, and that is an inside micrometer to measure holes smaller than 1½ inches. I have spent much time in thought on this subject, and several plans have occurred to me. For instance, one might have two points screwing into one another like the ordinary inside micrometer, as in Fig. 1, but with no graduation. After setting to fit the hole, I would then measure them with an outside micrometer. Another idea which struck me as possible was a thing like a glove stretcher, as in Fig. 2. This could either be fitted with a direct reading arrangement or could itself be measured. On the whole, however, I believe the most promising idea is that illustrated in Fig. 3. Here we have two semi-cylinders cut slightly on the skew. By having these arranged to slide over one another, and possibly dovetailed together, it would be possible to make minute adjustments, and the diameter could then be measured by the outside micrometer, or the faces could be graduated as in the sketch. I have long wanted an inside micrometer which would give me the bore of, say, a 1-inch hole within two or three ten-thousandths; it would be invaluable for limit gage work, to know how much, for instance, the size of a rose reamed hole in brass differed from one in gray iron.

J. S. V. BICKFORD.

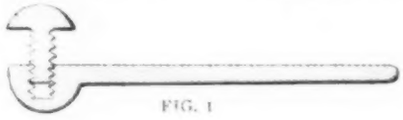


FIG. 1

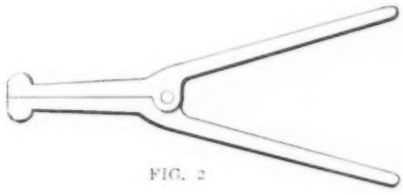


FIG. 2

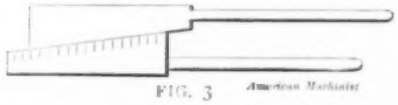


FIG. 3

INSIDE MEASURING DEVICES FOR SMALL HOLES.

Notes on Rope Transmission.

Editor American Machinist:

I have read with considerable interest the article entitled "Notes on Rope Transmission," by E. A. Reuleaux, at page 756, and upon examining Tables 1 and 2 carefully, I have found them to be old friends, which have been of considerable assistance to me.

The "ultimate strength in pounds," as given in Table 1, has been published for

the last ten years to my knowledge, and I have a blueprint table dated April 3, 1899, which I made at that time, and which is practically the same as Table 2, except that it does not include data on ropes larger than 1½ inches diameter, nor the "economical revolutions per minute." It gives the "speed in feet at 100 revolutions per minute," and by means of heavy lines the sheaves of 30 diameters and 40 diameters respectively are shown, as it is, of course, sometimes necessary to use less than 40 diameters of the rope. I have always considered this table dangerous, when employed by inexperienced parties, and have used it only as a guide, deducting the strain due to centrifugal force at the given speed.

One is often called upon to furnish a friction clutch sheave, in which case it is always advisable to furnish a friction clutch that is capable of transmitting the *maximum* power of the ropes over its respective sheave. For this purpose I have used Table 2, and am confident, from experience, that on this basis there is an ample factor of safety in the clutches employed. For this purpose particularly I reduced Table 2, about five years ago, to the following:

$$\text{H.-P. at 100 R. P. M} = \frac{D \times N}{F}$$

in which

D = diameter of sheaves in inches,

N = number of grooves,

F = rope factor from the following table:

Size of Rope, inch.	Rope Factor.
⅝	15.8
¾	13.2
⅞	8.4
1	7.0
1⅛	5.2
1¼	4.5
1⅜	3.5
1½	3.1
1¾	2.1
2	1.6

Friction clutches are rated at 100 revolutions per minute. It follows that if we equip a given sheave with a friction clutch, equivalent in power, at 100 revolutions per minute, we are perfectly safe, as the horse-power of a well-designed clutch increases directly with its speed (unless the speed be excessive), while the power of a rope sheave increases directly with its speed, *less the power lost by centrifugal force,* which increases as the square of the speed. Therefore within working limits of the clutch its power increases more rapidly than the power of its respective sheave. It is important to employ a friction clutch that will pick up the speed gradually; much more so than when belting is employed, because the rope transmission is practically positive in its nature, while a belt will slip if necessary, in starting. I have found the Caldwell double disk friction clutch entirely satisfactory.

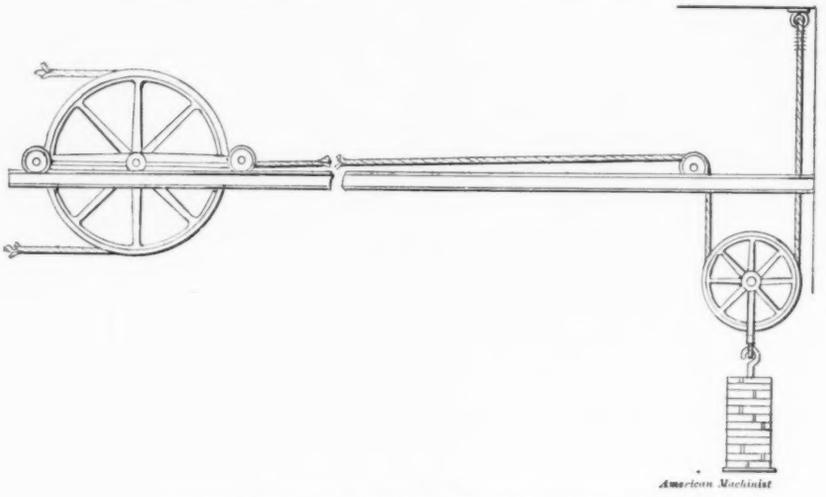
In figuring the power, the ultimate strength of ropes varies to such a great extent that it must be taken into consideration. I have before me a table of breaking strength, as given by one of the largest cordage manufacturers in the country, which gives the breaking strength of 1½-inch transmission rope at 15,700 pounds, while Table 1 under discussion gives 20,250 pounds. A splice, *as ordinarily made,* is the weakest part of a transmission rope, and as the strength of a chain is that of the weakest link, we are using far above 2 per cent. of the breaking strain, or, rather, parting strain, of the splice, if we use the figures given.

Regarding the weight of rope in the third column of Table 1, I would say that, to the uninitiated, the tabulated weights of ropes are a "delusion and a snare," particularly where the poor dealer sells the rope at a total price and relies upon catalog weights for his total estimated weight. Ropes of the same manufacture, and of the best ones at that, vary greatly in weight. I have seen 1½-inch transmission rope that weighed 81 pounds to the 100 feet, instead of 70 pounds, as tabulated.

Mr. Reuleaux states that "experience has taught us that the most economical rope speed, neglecting wear, is around 5,000 feet per minute." Why should we neglect "wear," which is certainly a very important factor? It would seem that he has given us the tables, including information regarding speeds, etc., necessary to determine the installation, *cheapest in first cost,* and that he has not taken durability and efficiency into account. I believe in taking these factors into account, and that a rope speed of from 3,500 to 4,000 feet per minute is the most economical, under ordinary conditions.

Table 3 might be used for a guide, but the dimensions given therein vary in sheaves of different manufacture.

In his various problems Mr. Reuleaux speaks of ropes from 2,800 to 3,900 feet long, but he has neglected to inform us that such a length of rope is excessive for one tension carriage to take care of properly, *under ordinary conditions;* and that it would be preferable, in good practise, to employ two or more carriages. I endeavor to use no more than from 1,800 to 2,000 feet of rope for one tension carriage to take care of under *ordinary* conditions, tho I have a drive in operation with approximately 3,000 feet of rope on a horizontal carriage, the drive running in a damp tunnel under ground from one building to another; and the tension carriage track runs the full length of the engine-room, which is about 60 feet long. As we had only about 30-foot drop for the tension weights, we brought the pull-back rope over its sheave, permitting it to hang down toward the floor, and fastening the end to the ceiling so as to form a loop, in which we placed a small swinging tension carriage, as shown in the illustration, from which we suspended double the usual weights. By this arrangement the weights would travel only one-half the distance of the tension carriage proper.



SWINGING TENSION CARRIAGE FOR ROPE TRANSMISSION.

So far as I know, the slack has never been taken up. ROBERT T. PEARCE.

Without being new, Mr. Reuleaux's tables are essential to the use of the information given in his article, and as they are not to be found in the usual pocket books, we considered their insertion entirely proper.—Ed.

An English Design of High-Speed Lathe.

Editor American Machinist:

At page 558 you publish a criticism of an article at page 312 relating to recent English designs of high-speed lathes, in which I think most of your readers would notice that the proportion of gearing did not gradually rise with the hight of centers.

In this connection a few points on lathe design should be remembered, such as the purchaser, the requirements of the specification, the width of belt, the size of the cone pulley, the purchase in the gearing, the diameter to be turned with gap out, etc.

Of two orders for, say, a 10-inch lathe from A and a 12-inch lathe from B, a gear ratio of 30 to 1 may be specified for one

and 20 to 1 for the other and both may be correct for the work they are to do.

I had an example like this to deal with a few weeks ago. I had two 10-inch lathes to design, both for the same firm, one to have a total ratio of 18 to 1 and the other of 12 to 1. The former was for turning roller steel and the latter mild steel.

The second point regarding the different diameters to be turned is settled by the purchaser. What is the object of dividing the largest diameter to be turned by the hight of centers? One can see that the purchaser of the 9-inch lathe wanted a deeper gap than the one who bought the 10-inch lathe. The English toolmaker is continually altering the size of gap.

The editor settled the third point, regarding the spindle speeds of the 9-inch lathe.

As for the high speed of cone pulley in the 10-inch lathe, I know for a fact that the 9-inch lathe mentioned, in which the cone makes 1,040 revolutions per minute, runs with the highest efficiency, and has done so these last three years. Motor shafts run at this speed and often faster. All that is required is a properly ground shaft, phosphor bronze bearings and good lubrication.

The comparison of the different lathes, made by your correspondent, is absolutely absurd to my idea. We do not know who purchased the lathes, or for what purpose. Perhaps they were for shipbuilders, toolmakers, sawmills, or other branches that require lathes. Perhaps the work required to be done on these numerous lathes varied (using the critic's term) as the price of cotton. They might have been for wood turning, zink turning, brass finishing, or the numerous kinds of steel.

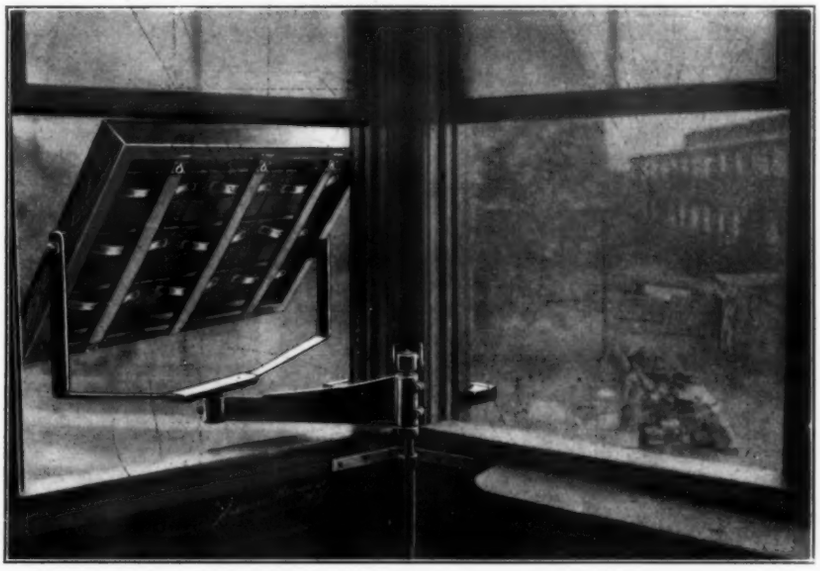
The critic has been misled by taking it for granted that the list was set as an "ideal," which was not even hinted at.

I have no hesitation in saying that if anyone required a whole set of lathes to deal with the same material, the speeds and gearing being left to the maker, we should see them gradually ascending, in cone diameter, width of belt, proportion of gearing weights, etc. YORKSHIREMAN.

Blueprinting Frame.

Editor American Machinist:

At page 762 of your paper I noticed an article describing a simple blueprinting frame and attachment. The similarity between the one mentioned and the one used here struck me at once, and I thought it might be of interest to send you pictures of ours. About the only difference is that we have a sort of bay window, which enables us to follow the sun around, with but one swinging arm for the frame.



BLUEPRINTING FRAME.

HEAD DRAFTSMAN ROBB ENG'G CO., LTD.
Amherst, N. S.

An Improved Lathe Tool Post.

Editor American Machinist:

The article at page 969, by "Tool Post," calls to mind two methods which I have used in making ordinary tool-posts and rockers, which may be of interest.

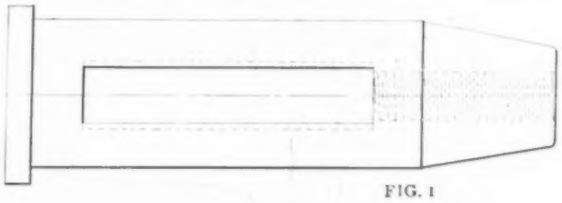


FIG. 1

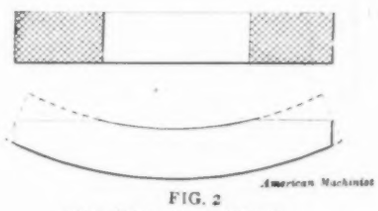


FIG. 2
TOOL-POST AND ROCKER.

Fig. 1 shows a tool-post made of a steel casting with the tool opening cored out. The lips at *ll* are left by the core as shown, so that when the post is turned in the lathe and the metal crumbles off on the side where the tool leaves the cut, we can file the lips off flush with the inside of the core at *c c* and leave the edges clean. This saves all plugging with hard wood and makes a good, clean job. All that remains to make it perfect is to polish in a grinding machine, instead of with a stick and emery.

The rocker in Fig. 2 is made by cutting off pieces of square cold-rolled stock the right length. They are heated to a dull red and pressed to shape under an arbor press, between two pieces of cast iron, rounded to a trifle smaller radius than is required, as they will spring back a little. This gives us a piece the shape of the dotted lines. These are placed four or six at a time in the shaper and reduced to the shape of the full outline and then swung to 45 degrees each way and checkered. We simply case-harden them, but they may of course be buffed up as much as required. By a little care in rounding the dies, and in heating evenly, there will be no trouble about getting the curvature just as wanted. E. H. FISH.

Worcester Polytechnic Institute.

Making Lead Castings in Gray Iron Molds.

Editor American Machinist:

I am making molds for lead grids used in storage batteries. While I have been very successful in producing accurate molds, I have as yet discovered no way to coat the surface of the mold so that the metal will flow readily. I make the molds of gray iron and use soapstone for facing, but with poor results. If you could let me know what to do I would be grateful. ERNEST BECKER.

[Our impression is that no facing or coating is required for the surface of the mold and that all the trouble arises from the mold being too cold when the metal is poured. Warm the mold and try it again. We have known good results from the practise of smoking the mold surface before pouring, but doubt whether the smoking was really necessary.—Ed.]

A Blueprint Wrinkle.

Editor American Machinist:

Where copies of tables or reading matter are wanted, too many for carbon and too few for mimeograph, make one carbon copy on soft white tissue (letter press paper) and blueprint. Use a fresh, clean sheet of carbon, and if typewriter copy the

type must be clean. The result is very fair. C. W.

[The result, as shown by a blueprint received with this letter, is a good deal better than "very fair"—in fact, the print is about as sharp as if made in the usual way from a tracing.—Ed.]

Milling Hexagons on a Profiling Machine.

Editor American Machinist:

The hexagons on brass castings, such as valves, nuts, etc., are often cut to size on a milling machine by a pair of straddle mills. One disadvantage of this method is that the corners of the cutters have to do all of the cutting and are quickly worn down. Another way is to use a wide cutter and cut each side separately. The cutter will last longer, as not only is the whole length of the cutting edge at work, but also it gets under the hard surface. Of course more time is required to do the job in this way. We have done a lot of this work on automatic profile milling machines. This is a quicker method, the cutter being at work continuously. As the accuracy of the work depends on the dividing plate, when done on the miller, so does it depend on the copying plate when done on the profiler. I propose to show here how to lay out a plate which will shape up a hexagon correctly.

To those not familiar with a profiler I may say that it is identical in principle with the old copying lathe. A plan of the operation is given in Fig. 1. A headstock similar to that of a lathe carries the cutter. An adjustable rest is fitted with a cross-slide on which is a bracket holding a mandrel. On one end of this mandrel is a left-hand thread on which is screwed the plate, to which the work must be secured. On the other end is keyed a worm wheel, thru which it is driven. When at work the plate is pressed against a small roller by a heavy weight attached to the cross-slide by a chain. The work has thus two simultaneous motions, one of rotation, the other an oscillation or a back-and-forth movement, in a plane perpendicular to its axis.

If the diameters of the cutter and the roller could be neglected, one side of the plate would be set out as follows: With center O, Fig. 2, and radii respectively equal to that of the blank plate and of the circumscribing circle of the hexagon to be cut, draw two arcs subtending an angle of 60 degrees. The chord of the smaller arc is a side of the required hexagon. The length enclosed between chord and arc on each radius, 02, 03, etc., gives the distance moved by the slide during the rotation of its work thru the angles 102, 103, etc., thus bringing the work up to the cutter and forming a flat side. Each of these lengths is set out on the radius containing it, from the outer arc, toward the center, and the ends are joined by a curve. This curve forms one of the similar sides of the plate.

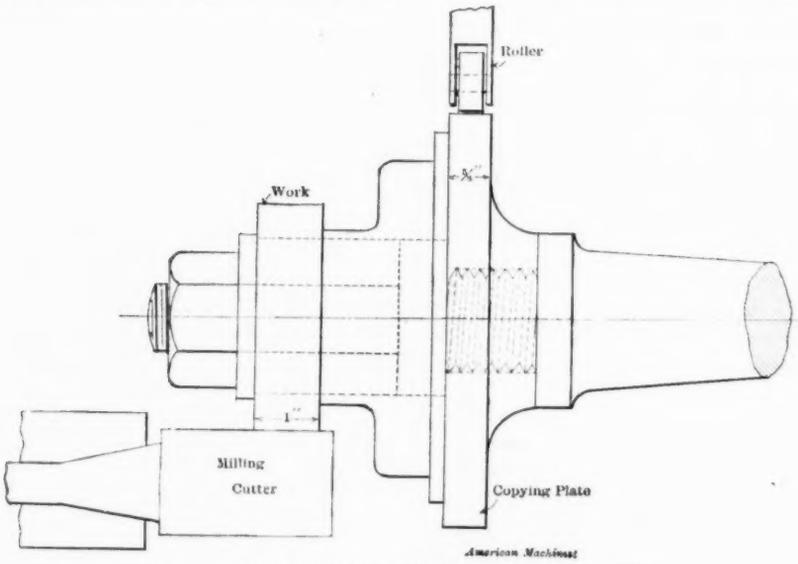


FIG. 1. PLAN OF HEXAGON PROFILE MILLING OPERATION.

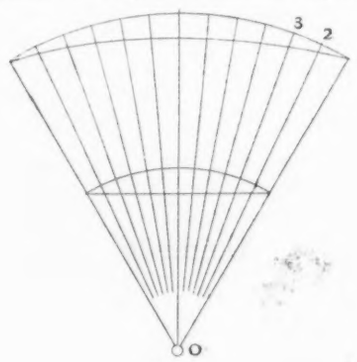


FIG. 2

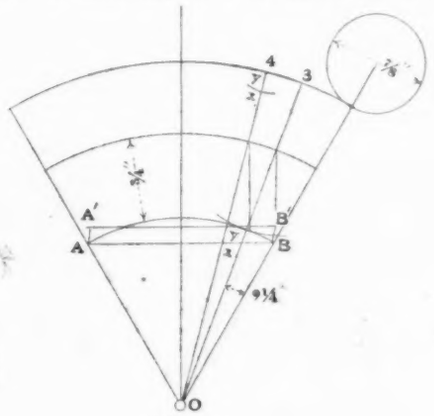


FIG. 3

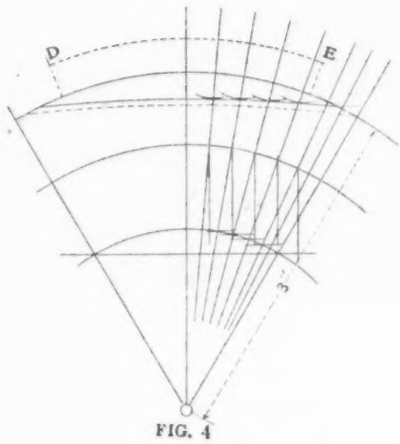


FIG. 4

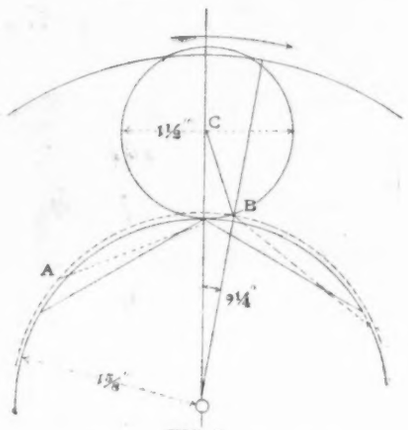


FIG. 5

American Machinist.

LAYING OUT PATTERN PLATE FOR HEXAGON PROFILE MILLING.

It will be seen on consideration that this plate could not be used to form a flat-sided hexagon. To obtain the true curve, suppose one side, $A\,B$, to be formed correctly. Let the slide be fixed with the corner B, Fig. 3, just touching the cutter. Rotate the plate till $O\,4$ becomes horizontal. As the axes of cutter and work are both in the same horizontal plane, $O\,4$ will now contain the center of the cutter. Draw a circle the size of the cutter, with its center or $O\,4$ tangent to arc $A\,B$. Suppose the slide to be moved till $A\,B$ becomes tangent to the circle, all points in $A\,B$ moving parallel to $O\,4$. $A'B'$ is below the intersection of arc $A\,B$ with $O\,4$, showing that the curve obtained in Fig. 2 is incorrect. Let $O\,4$ intersect the lines $A\,B$, $A'\,B'$ in x and y, then $x\,y$ is the distance to be moved. Set out on $O\,4$ $x'\,y' = x\,y$. With center on $O\,4$ draw thru x', the roller circle. The curve must be tangent to this circle. By taking several radii, a sufficient number of circles can thus be obtained, to enable the curve to be drawn as shown in

Fig. 4. It can be seen, looking at Fig. 5, that the work rotates thru about 9¼ degrees before the cut on the side commences, *A B C* being 90 degrees. The whole side is thus cut during a rotation of about 41½ degrees, as shown by the dotted arc *D E* in Fig. 4. The portions of the curve outside this arc keep the corner intact. In practise it is convenient to continue the sweep of the curve thru the 60 degrees, as shown in Fig. 4 by the dotted curve. The corners of the work are thus kept well clear of the cutter, and it is easier to apply the templet correctly to the divisions on the plate, which may be marked off on a dividing head. G. H.

Wolverton, England.

A Radius Gage.

Editor American Machinist:

The sketch shows a radius gage which is simply and easily made and when finished is absolutely correct, which is the main feature in its favor. This one represents the ⅛ and 5-32 inch radii. To make, take a piece of wire 3-16 inch thick and 4 inches long, taper the ends down from ¼ inch back to about 5-32 inch at point, and cup the ends out to about fit the surface of the ball to be fitted on. Secure two hardened steel balls ground to exactly .250 and .3125 inch in diameter; these can be secured up to ½ inch in diameter from almost any dealer in tools, and from the large dealers in sizes up to 2 inches. Now sweat a small spot of solder on each of the balls, being very careful not to heat them enough to injure them. Next sweat the cup ends of the

A RADIUS GAGE.

rod full of solder, then heat the rod one end at a time to a pretty good heat (not red hot) and press on to the soldered portion of the ball it is cupped out to fit, and let cool. The rod need not be heated enough to draw the temper of the balls in the slightest, and you will still have a perfectly firm joint. Take to the lathe, file off solder, polish nicely and you have the most perfect radius gage which can be produced. T. W. Booth.

Moriarity Gives Credit for a Good Job.

Editor American Machinist:

"Come along wid me, Dixie, an' bring a couple o' min an' two pair o' poipe tangs; they's a poipe bursted in th' wather circulatin' grate down to Miller's candy facthry." So I got the men and the pipe tongs and, putting a flat and cape chisel in my pocket, hammer in hand I accompanied Mr. Moriarity to the basement of the candy factory.

The grate had been invented by a compatriot of Moriarity, and was of the rocking variety. Between the rocking members of the grate were several 2-inch pipes, thru which the feed water was circulated to warm it up before entering the boiler. Owing to the excessive expansion and contraction (the top of the tube being in direct contact with the red-hot fire), one of these pipes had opened up at the weld for about 2 feet. When we got there the boiler was cool, and the two men and I crawled into the furnace and got our pipe tongs on the pipe, Moriarity remaining outside to "shuperintind" the job. We were rather cramped for space, but at length, with tongs in place and our feet up against the wall, we pulled and strained at the pipe, while Moriarity through the furnace door shouted encouragement to us: "Pul now, byes; let her hov ut," etc., etc. But we could not budge the pipe.

"Mr. Moriarity, you will find my hammer out there, and two chisels in my pocket; if you'll pass them in here I'll cut the pipe off."

"No, Dixie, me maan, it wud taake yez too long. Ut's more presteedge ye want. Oi'll go up to th' shop an' git two more min an' two pair o' chain tangs; more presteedge wull do th' job." So Moriarity hiked off to the shop for more prestige in the way of two pairs of chain tongs and the necessary complement of men to handle them.

While he was gone I got to work with my chisels, cut the pipe off close to where it was screwed into the plate at the back of the furnace, and then with the cape chisel split the threaded part from end to end, and screwed it out with my fingers. Half an hour or so afterward Moriarity appeared with the men and the chain tongs.

"Phwat th' h——l are yez doin' out here wid yer min, Dixie?"

"We've got the pipe out, Mr. Moriarity, and as you left no instructions, I"——

"No insthructions is ut? Oi'm sure yez moight luk as af ye was wurrkin. Ye've got her out, an' how dud yez git her out?"

"I cut the pipe off with a chisel close up to where it is screwed into the back plate."

"Yis, an' lift th' ind av ut screwed into th' baack plate, Oi'll bet; an' now ye'll tell me how yer goin' to git thot out?"

"Here's the end, Mr. Moriarity; the whole job took only twenty minutes."

Moriarity said no more about that part of the job, but put the little end piece in his pocket. After taking the measurements a new pipe was made and screwed in place.

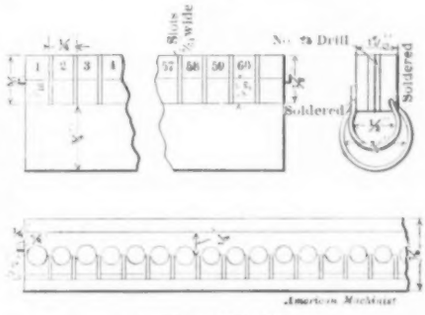
Two or three days after this I was standing at my desk in the shop. My desk was separated from Mr. Moriarity's office by a ground-glass partition with remarkable acoustic properties. As I stood there I heard Moriarity addressing a mechanical engineer, Bennett by name, who used to call in occasionally.

"Binit, phwat d' yez think o' thot domd dumb fureman o' mines? They was a bit o' a poipe bursted down to Miller's candy facthry. Oi sinds him down t' luk at ut. He taakes four o' me bist min—min thot are earnin' twilve cints an hour—an' four pair o' poipe tangs. Afther potherin' 'roun' fer two hour, back he comes, and sez, sez he, 'Ut's more presteedge we waants.' So Oi taakes me bit hammer an' chisel an' cuts her out mesilf in tree minutes b' th' watch. Yez hov no idee, Binit, phwat a lot o' trouble thot maan gives me. Faith, Oi near hit him over th' head wi' a-a-a cuspitoon th' other day. We was talkin' over th' lot o' coal th' biler wor burnin' (he t'inks he knows a lot because he wor a ingine-eer at say). Sez he: 'Mr. Moriarity, there's more heat eunuchs in a poun' o' Welsh coal nor there be in a poun' o' antrysite.'" "And what did you say?" said Bennett. "Oi said, 'Ye're a domd liar.'" "Yes," said Bennett, "but that didn't prove anything." "No," replied Moriarity, "ut didn't prove nawthin', but ut shut him up." Dixie.

A Drill Holder.

Editor American Machinist:

The illustration shows a drill-holder for a toolbox, which is very handy and useful. It can be carried in the toolbox lid. It is



A DRILL HOLDER.

stamped and the right drill presents itself to the eye immediately. There is no danger of the drills being displaced, even with the roughest handling. It consists of two pieces of brass or copper tubing and two pieces of flat brass which are soldered together and drilled. After drilling the solder joint between the two flat pieces is broken, the outside piece of tubing acting as a spring and keeping the drills in position. The ⅛ pins on the ends are for small spring clips to bear upon, which hold it well back against the toolbox lid. If the holes are drilled a neat fit they will act as a gage, and it will be found that no drill except the right one will go in without appearing too easy or too tight for the hole. I give sizes for the one I have, but they can be altered to suit other boxes. Nomad.

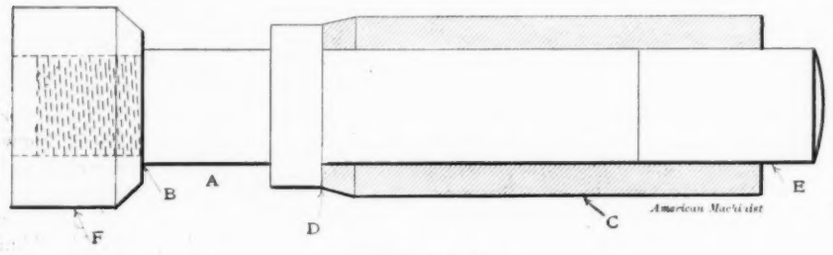
Putting on Stock

Editor American Machinist:

After making a large quantity of studs like the one shown in illustration we found the size at *A* was just one and one-half thousandths too small. We fixed them and in very short time, too. One of the

foremen designed and built an outfit shown in the sketch.

F screws on the lower end of the stud, bringing up against the shoulder *B*. *C* fits down on the upper end of the stud and rests on the shoulder *D*. *E* is a short plug the upper end of which is well rounded



PUTTING ON STOCK.

and the lower end flat. It fits freely in *C*. Remove *C* and *E* and heat the stud at *A* as evenly as possible, cool off the upper and lower ends of the stud, put *C* on, rest *F* on the anvil, and after putting *E* in place hit the round end a sharp rap and the fit at *A* is enlarged from five to ten thousandths, according to the weight of blow. All that remains to be done now is to grind *A* to size.

The surprising feature was that after doing the lot and testing them on centers, they ran out only from two to three thousandths; the round end at the top of *E* accounts for the accuracy in that respect, I think. C. M. C.

High Speed Steels

Editor American Machinist:

In these steels for fine tool work the hardener has his troubles in heating, especially in the open fire (coal, coke or charcoal), as the sharply projecting portions become heated sooner than the main body of the tool, and if the large portions are not up to the proper heat when dipped the tool is very liable to crack. Then in the grinding there is one fault (if we can call it a fault of the steel) that will limit its use in many cases.

Cracks are formed on the surface, especially in surface grinding. For instance, a certain brand, which by the way does not come under the head of high-speed steel, yet has in its composition a considerable amount of tungsten, gives a good demonstration of the effects of the emery wheel, the cracks and the loss of hardness on the surface of the cutting edge where it is most wanted being caused by grinding upon hard, rapidly revolving emery wheels, even if the latter run wet.

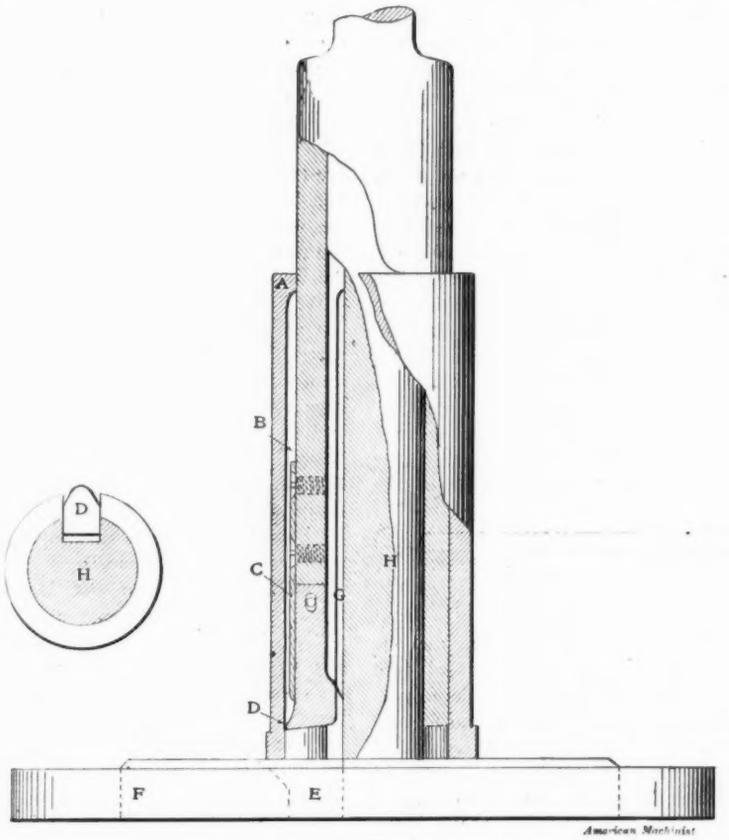
The wheel attacks the surface of the steel and this surface, being suddenly heated to a high temperature, a change in volume takes place, in consequence of which cracks are formed, and the hard surface is lost; in fact, I have seen cases where the surface could be filed as easily as a piece that had a low spring temper.

With such emery wheels rapid cooling by the water is effected only after the tool has been pressed against them, the water remaining ineffective during that operation. As before stated, in consequence of this heating a superficial change in the volume of the steel takes place, the steel endeavors to contract, which is prevented by that portion underneath which is still cold. The nearest approach to a solution of this trouble, I think, is to find an emery wheel that will cut tungsten steels the same as the wheels now in use cut our common steels; to use a slang phrase, it's "up to" the emery-wheel man, and the one that produces a wheel to do this has the market, for high-speed steel has come to stay. E. W. N.

Cutting Oil Grooves With a Drill Press.

Editor American Machinist:

I send you this sketch of a tool that I have designed for cutting oil grooves. I used it in an old drill press. By means of the long feed lever the grooves are cut with one downward stroke 1-16 of an inch deep. This depth can be increased by adjusting the rib upon which the tool cutter slides. The sketch shown is for cutting straight grooves, but I have lately changed it to cut a spiral groove. This tool has been used on phosphor bronze bearings of diameters from ⅝ to 2¼ inches by ¾ to 7 inches long, with perfect satisfaction. Its ability to cut internal grooves of any form desired can be judged from the following every-day record. The sketch shown, *A*, is a phosphor bronze bearing 1¼-inch hole 4 inches long, 1 11-16 inches diameter, with one oil groove nearly finished. *B* is oil groove nearly finished. *C* is a spring to keep the cutting tool *D* back against the rib *G*. *E* is a hole for the chips to fall thru, and *F* is the base clamped to the drill-press table with the vertical stud *H* which carries the rib *G*. A lot of seventy-five of this size are finished with three oil grooves in one hour, with ordinary help. Jos. H. Blair.



CUTTING OIL GROOVES WITH A DRILL PRESS.

The McCormick branch of the International Harvester Company is to build at its works in Chicago a clubhouse and dining hall for its employees at a cost of $75,000. The dining rooms will accommodate 800 persons, and meals are to be served at cost, which is estimated to range from 4 to 11 cents. The dining room will be readily convertible into a meeting room or theater. The building will also contain reading, billiard, card and living rooms and offices with all necessary accessories. At the Springfield works of this company a baseball park is maintained and games take place in it Saturday afternoons.

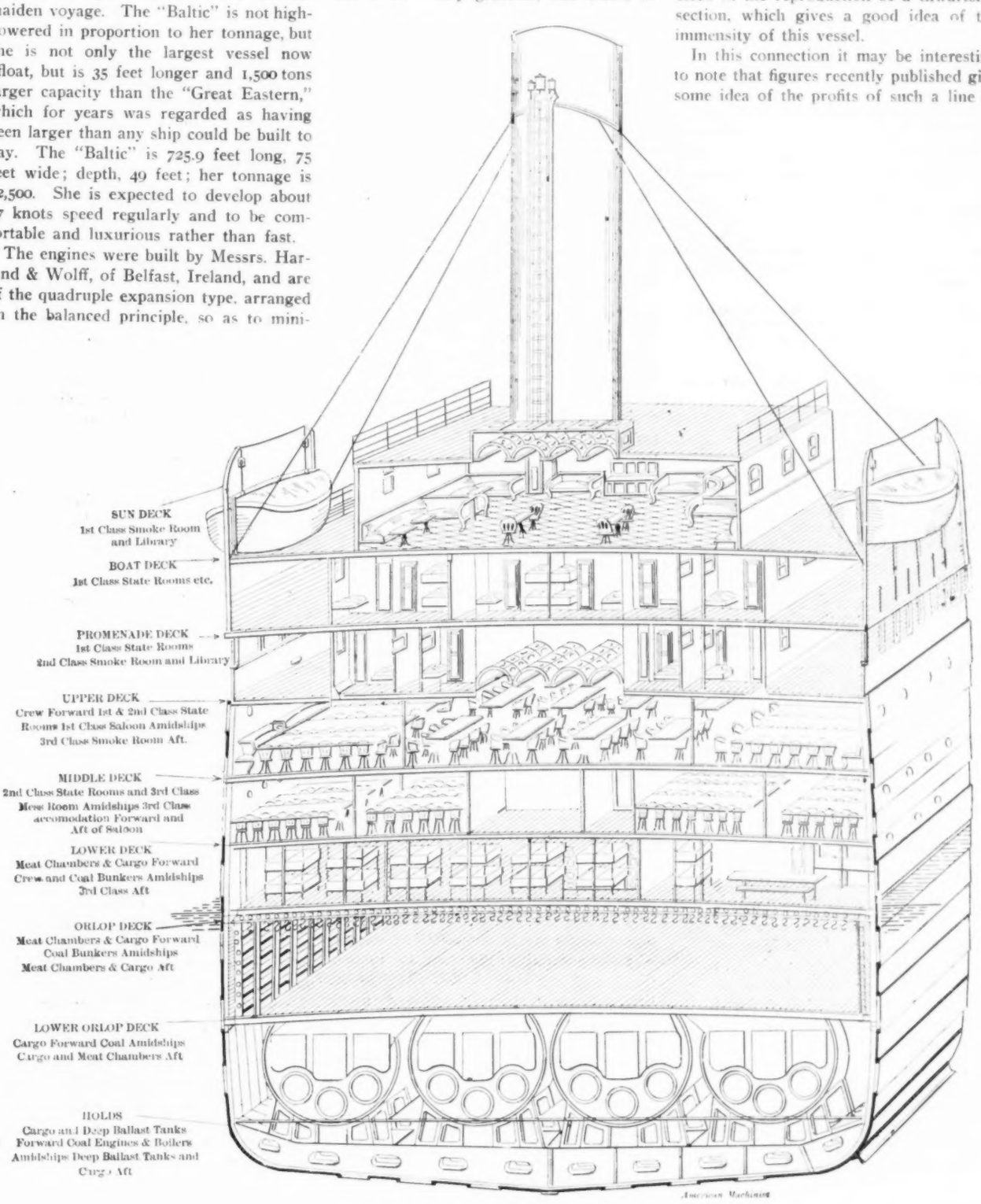
The Baltic.

Most of our readers have heard more or less of the great steamship "Baltic," of the White Star Line, which recently came to the port of New York on her maiden voyage. The "Baltic" is not high-powered in proportion to her tonnage, but she is not only the largest vessel now afloat, but is 35 feet longer and 1,500 tons larger capacity than the "Great Eastern," which for years was regarded as having been larger than any ship could be built to pay. The "Baltic" is 725.9 feet long, 75 feet wide; depth, 49 feet; her tonnage is 22,500. She is expected to develop about 17 knots speed regularly and to be comfortable and luxurious rather than fast.

The engines were built by Messrs. Harland & Wolff, of Belfast, Ireland, and are of the quadruple expansion type, arranged on the balanced principle, so as to minimize vibration. High speed is not aimed at, but a good moderate speed and great comfort are assured. The vessel is a twin-screw, and her engine-room and stokeholds are well ventilated, and thus the firemen come within the scheme for giving everybody roomy and healthy surroundings.

In the water the "Baltic" looks very much like any other steamer of her class. She is extremely graceful, and seems to sit upon the water in a way that gives little idea of her immense weight. At present she is not able to take her full load across the bar at the entrance to New York harbor by 6,000 tons (a respectable cargo for a tramp steamer), but a new channel is being dredged, which, when finished, will admit her at full draft. Many of our readers, especially those who live far from the seaboard, may be interested in the reproduction of a thwartship section, which gives a good idea of the immensity of this vessel.

In this connection it may be interesting to note that figures recently published give some idea of the profits of such a line of steamers. These figures show that this company made in a single exceptional year (1900) 100 per cent. on its capital stock. Of course there were years when it did not do nearly so well, but 20 per cent. and even 50 per cent. have been not uncommon.


SUN DECK
1st Class Smoke Room and Library
BOAT DECK
1st Class State Rooms etc.
PROMENADE DECK
1st Class State Rooms
2nd Class Smoke Room and Library
UPPER DECK
Crew Forward 1st & 2nd Class State Rooms 1st Class Saloon Amidships 3rd Class Smoke Room Aft.
MIDDLE DECK
2nd Class State Rooms and 3rd Class Mess Room Amidships 3rd Class accomodation Forward and Aft of Saloon
LOWER DECK
Meat Chambers & Cargo Forward Crew and Coal Bunkers Amidships 3rd Class Aft
ORLOP DECK
Meat Chambers & Cargo Forward Coal Bunkers Amidships Meat Chambers & Cargo Aft
LOWER ORLOP DECK
Cargo Forward Coal Amidships Cargo and Meat Chambers Aft
HOLDS
Cargo and Deep Ballast Tanks Forward Coal Engines & Boilers Amidships Deep Ballast Tanks and Cargo Aft
American Machinist

CROSS-SECTION OF THE "BALTIC."

AMERICAN MACHINIST

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Technical Education in India

We have received from the *Indian Engineer* some particulars regarding the workings of technical education in India which are not of a reassuring character.

In 1888 the Indian Government established the Victoria Jubilee Technical Institute for the purpose of training native students in engineering and cotton manufacturing, which latter, as a large and rapidly growing industry in India, seemed to offer excellent opportunities for the employment of the graduates of the institute. The leading positions in Indian cotton mills are held by Englishmen, while the operatives are of course natives, and it was felt that with proper training opportunities for the advancement of native graduates would be plentiful.

The patronage of the institute at the start was very encouraging, and by the end of the first three years of its work ninety-nine students had passed the final examinations successfully. During this period the number of cotton mills in the country had increased from 114 to 134, and by 1896 this number had increased to 192, containing 5,043,300 spindles and employing 181,400 hands. Here certainly was an excellent opportunity for the graduates of the institute had they proven themselves competent. According to the official statistics of the institute, the average earnings of the graduates in engineering is 100 rupees, or say $32 a month, while that of the textile branch was 80 rupees, or about $25, while, on the other hand, complaints are made that many graduates have been unable to find any employment.

Along with this discouraging experience there has naturally been a falling off in the attendance at the institute, and the cost of conducting it, when compared with the meager results, has become excessive. For the past few years the number who succeeded in passing the final examinations has averaged but thirty, and as far back as 1895 the cost of the school per annum for salaries alone was 50,000 rupees, or about $15,000 per annum.

At about this time the unsatisfactory nature of the results accomplished attracted serious attention; the work was reorganized and additions were made to its scope, these additions including metal working, enameling and electrical engineering. The additions involved an immediate outlay of 50,000 rupees, together with additional annual expenses, but the result was again disappointing, the metalworking and enameling departments being admitted failures.

To sum the matter up, the institute has admitted during its existence over 2,600 students, but of these only 382 have been able to pass the examinations, while the expenditure has aggregated over 1,000,000 rupees, or say $320,000.

The results, we believe, show the enormous difficulty of educating one race of men by another of habits of thought which are so fundamentally different that they cannot be comprehended, much less understood. Perhaps this experience of the Victoria Jubilee Institute may indicate the nature of the difficulties which we have to face in the Philippine Islands.

A Marvelous Machine.

We have received a little pamphlet entitled "The Fuel Question Solved and the Smoke Nuisance Avoided." On reading this remarkable literary effort we find that not only has the "smoke nuisance" been avoided, but common sense has also been sidetracked. We print here a few extracts illustrating the thermodynamical versatility of the Tri-motor and the Tri-mo heater:

"The combustion chamber being entirely surrounded by water, prevents the loss of heat; the resulting gases of combustion being discharged downward in a zigzag flue in contact with an ascending column of cold water, by which all the heat is recovered from the residue of combustion which escapes colder than the surrounding atmosphere. . . . Thus establishing the fact conclusively that all heat of perfect combustion is utilized. . . . Tri-mo heaters are adapted to all heating and lighting purposes from the small isolated houses to the largest buildings. . . . It also pumps the water supply, drives the dynamo for electric lighting, and supplies gas for cooking purposes; all this service can be had at less than one-fourth the price now paid for heating alone. . . . The Tri-mo heater, for a given amount of work, requires only one-third the space occupied by the old steam heater. Doing its own firing, it does not require special attention more than once or twice a week, and can be regulated to give any desired temperature to rooms either in cold or warm weather. . . . The Tri-motor attached to street cars makes each car separate and distinct, dispensing with power-houses, boilers, engines, dynamo and trolley wires. Thus, when one street car is disabled, it can be taken up by the next car without disturbing or interfering with the operation of the road; enabling new roads to be constructed for one-half the present cost, and the operation of them at least one-third the cost of the present electric road. With crude oil at $1.00 per barrel, each Tri-mo street car can be run twelve hours at a cost not to exceed 40 cents. . . . All these operations being performed by a combination wheel and guiding lever, and two-passenger Tri-mo carriage can be run 100 miles at an expense not to exceed 5 cents. . . . The Tri-motor as adapted to locomotives dispenses with boiler, smokestack, smoke nuisance and fireman. A train can be run from New York to San Francisco without stopping for fuel or water. The exhaust steam, being condensed, its latent heat conserved and the water used over and over. The economy of fuel in this service alone in the United States will save railroad companies many millions of dollars per annum. . . . In fact, upon

investigation, it will be found that this invention revolutionizes the motive power of the world."

What a powerful ally the assassin of the future may find in the Tri-mo heater. No incriminating bludgeon or gun, stiletto or poison. He will just sneak into his victim's comfortable apartments, and without disturbing him shift the Tri-mo indicator to 40 degrees below, and the job is done.

Some New Things

THE "FOOL PROOF" ROTARY ENGINE.

The half-tones show the essentials of a new rotary engine built by the Cooley Gen-

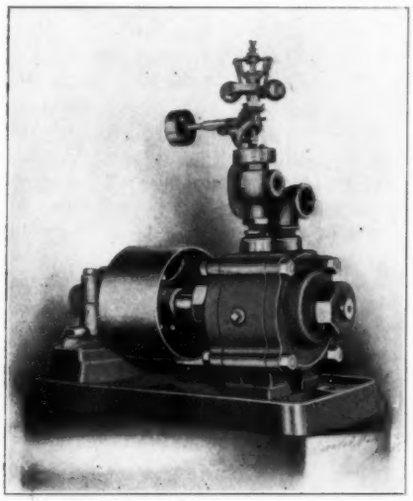


FIG. 1. "FOOL PROOF" ROTARY ENGINE.

eral Development Company, 620 Atlantic avenue, Boston, and definitely named the "Fool Proof" engine. Fig. 1 shows the engine complete and Fig. 2 shows all the details of the engine proper. The cylinder is double or has a steam chamber surrounding it with partitions at the top and the

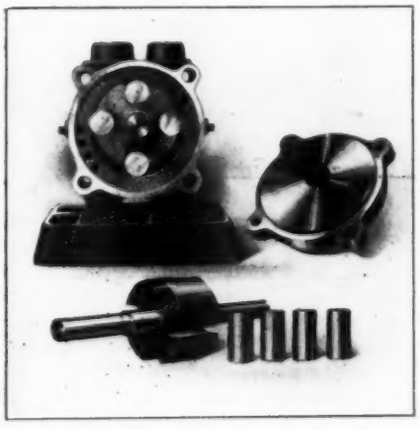
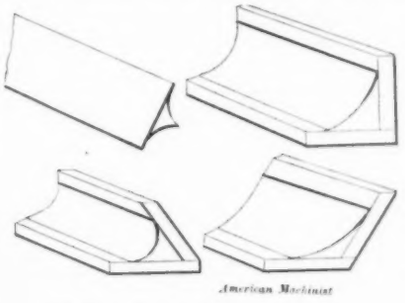


FIG. 2. DETAILS OF ROTARY ENGINE.

bottom. The shaft is placed eccentrically in the cylinder and the piston is fitted to travel as close as possible to the shell at the top and with no play endwise. The rollers have just sufficient freedom endwise to allow them to roll with ease and the centrifugal force keeps them out against the shell when running. The steam is admitted by the two holes at the upper right-hand and exhausted by the four holes opposite, both covers having channels cut in them for the passage of the steam, no other ports being required. The steam is admitted and discharged thru pipes connected with the top of the engine. The makers of the "Fool Proof" engine have records of tests which they will doubtless send to those interested.

CURVED SIDE LEATHER FILLET.

The cuts show different applications of the curved side leather fillet for pattern-makers as manufactured by the Canton Fillet Company, Canton, Ohio. The curving of the sides which fit into the angle of the pattern enables it to accommodate itself perfectly to either acute or obtuse

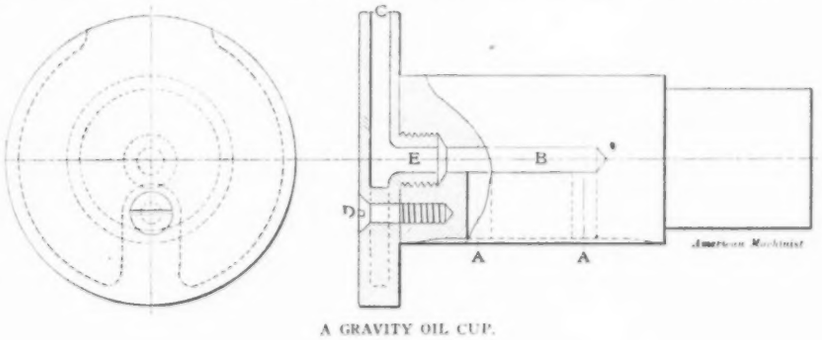


CURVED SIDE LEATHER FILLETS.

angles, as shown. It is made usually in 4 foot lengths and in sizes from 1-16 to 1 inch.

A GRAVITY OIL CUP.

The accompanying illustration shows an oil cup which is designed for lubricating parts which run on stationary studs and shafts. It takes the place of the head on a stud. The oil cup is made of composition bronze casting, the chamber being cored out for an oil reservoir. The cup may be readily screwed into place by inserting a piece of flat stock in the opening of the oil reservoir *C* and using it as a



A GRAVITY OIL CUP.

lever. When the oil cup is in position with the opening of the reservoir upward, the screw *D* is inserted to prevent it from turning or working off. In order to feed the oil to the bearing the stud has a hole *B* drilled lengthwise connecting with a similar hole *E* to reservoir *C* and one or more holes *A A* drilled from the perifery to meet it. In addition, the perifery is channeled, forming an oil-containing groove where holes *A A* join the outer surface of the stud. The flow of oil can be regulated to suit the occasion by the relative positions of holes *A A*. The illustration shows these holes opening downward, which will allow the maximum supply of oil. If this position is reversed and these holes open upward the minimum supply will result. By altering the position of these holes between the extremes just mentioned, practically any desired amount of lubrication may be obtained. This oiler is manufactured by the Meisel Press & Manufacturing Company, 944-948 Dorchester avenue, Boston, Mass.

An Inspection of the New York Subway.

One of the steam locomotives which until a short time ago it was declared afforded the only known practical means of drawing trains over a road designed to handle traffic in New York city, is now being used in the new subway for drawing cars with materials, and occasionally some visitors who are fortunate enough to be invited to inspect this new feature of New York, which, when completed, will constitute the greatest system of urban underground railways in the world, and is one of the largest undertakings in the way of an engineering construction. Mr. McDonald, the general contractor for the work, invited a party of the technical editors of New York to go thru the subway with him the afternoon of the 1st inst., and, seated comfortably on a flat car pushed by the aforesaid locomotive, an excellent opportunity was afforded for seeing just what the tunnel will be like. There are four tracks (side by side for the most part), those for the local trains being outside and those for express trains inside. At the stations for local trains there are station platforms of concrete, level with the floor of the cars, these platforms being roomy and long enough for twelve-car trains. The stations themselves are models of convenience and good taste, everything about them being designed with a view to facilitating movement of trains and passengers and to the maintenance of the best and most sanitary conditions. Express trains will have no facilities for discharging or taking on passengers except at express-train stations, which are at comparatively long distances apart (twenty blocks or more). The local trains can leave or take on passengers at all stations. At express sta-

tions the four tracks are simply spread far enough apart to permit platforms to be placed between the local and the express tracks, so that passengers can, at such stations, transfer themselves from local to express trains or *vice versa* by simply walking across these platforms, which at the same time are accessible from the street as well. A novel feature of the road consists of the fact that department stores and office buildings will in many cases be so located that the first floor below the ground level will be level with the station platforms and contiguous to them, so that show windows will in some cases open directly upon the station platforms. The stations are distinctly cheerful looking places, and, with the much improved time that will be made when the electric trains are running—three minutes from City Hall to Fourteenth street, and six minutes from City Hall to Forty-second street—the road will be, we predict, very popular and will do much to enhance the attractiveness of life in New York.

Apprentices Sent to the World's Fair

The Midvale Steel Company, of Germantown, Pa., is sending its apprentices to the World's Fair in gangs of eight—seventeen gangs in all—with expenses paid and wages continued from the time they leave Philadelphia until their return. One gang leaves Philadelphia every Saturday noon, stopping at Washington to see the navy yard and other points of interest. They travel in strictly A1 style. While in St. Louis they will stop at the Westmoreland Hotel. About sixty of the boys have already visited the Fair, and they are a bright, wideawake lot of fellows. Within two weeks from the time they return to Philadelphia each will be required to write a letter to the president of the company, C. J. Harrah, stating what he has seen, and his impressions of the great exposition.

Samuel Gompers and President O'Connell of the International Association of Machinists with a committee called upon President Roosevelt on August 4 to ask that the wages of machinists employed in the Washington Navy Yard be increased. They were promised that a report would be asked for from Secretary Morton and action would be based upon his report.

It is announced that the government will probably accept the battleship "Ohio," which has been built by the Union Iron Works and which failed to reach her contract speed of 18 knots. The deficiency is about .2 knots and $18,000 may be deducted from the contract price, $2,899,000.

The employees of F. E. Myers & Brother, Ashland, Ohio, manufacturers of pumps and hay tools, with a large number of the residents of the city and the neighboring towns, enjoyed a monster excursion and picnic on July 30. The place visited was Silver Lake, a popular resort near Cleveland.

A Contribution to the Theory of High Speed Steel.*

BY H. ECKARDT.

Regarding the manner of operation of rapid cutting steels in general, I must cite the opinions of Geheimrat Professor Reuleaux, in the Association for the Promotion of Industry, November 5, 1900, and can endorse his views as rigorously correct throughout. With Taylor-White steel, as with all others, the chips are not cut off by the extreme sharp edge of the tool; but by virtue of the high pressure at which they impinge on the top of the tool some distance away from the cutting edge they are torn loose or split off from the work. That this process takes place in practise is very clearly shown by the upper surface as well as the cutting edge of a tool that has been used. The process is sketched in Figs. 1 and 2. After close observation of such a tool it has been remarked that on the edge, so far as the breadth of the chip extends, quite a high ridge has appeared. Behind this ridge and on the top surface there begins a place where the surface is much ground away, to the breadth of the chip. When the ridge, which adheres but is not welded on, has been removed by light blows the small area to which it was attached as well as the cutting edge, is seen to be entirely uninjured and smooth, while on this surface are perceptible such fine cracks as might be made by the grain of a grindstone. The tool is neither ground away nor blued† on the edge. Moreover, the lower surface of the ridge that has been removed is metallically clean, while the two surfaces which were in contact with the work and the chip are blued [*angelaufen*]. This phenomenon shows that the ridge was formed of metal particles which were not so heated as to melt. It shows further that the ridge was formed before the point of the tool became so hot as to make tempering colors thereon. Still further it shows that this ridge consists of metal particles which did not proceed from the highly heated chips but from such fragments of metal as remained hanging to the work when the chips were torn off, and which must have been removed by the scraping motion of the work against the edge of the tool; by which means the space between work, tool and chip was filled out. From the hight of this ridge, therefore, it may be perceived how far the point of separation of the chips from the work lies above the edge of the tool.

The opinion of many specialists in opposition to Geh. Reuleaux that this ridge forms the true edge and cuts off the chips is incorrect. In order that this work should actually be done by the ridge this would have to be harder than the material that is being machined. A simple test with a file shows, however, that the ridge is not hard but very soft. The great wearing away of the top of the tool affords another proof of the splitting action in working. This wear could not begin at a distance from the extreme edge if that were in contact with the place of separation of the material; in that case the grinding away would begin at the point of contact of edge and chip. In such case, however, the thin edge would be greatly heated by the frictional work of separating the chip, and were there insufficient means of leading off the heat generated the edge would soon be overheated and ruined. Thus may we explain the quick destruction of the edge of much-used tools. The worn area on top of the tool (Fig. 2) is then so much increased and extends so near the edge that the edge is too thin to carry off the heat and, as already explained, it quickly becomes overheated and thereby suddenly destroyed. The longer therefore the area

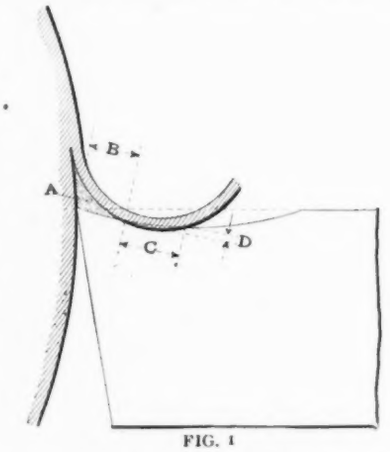


FIG. 1

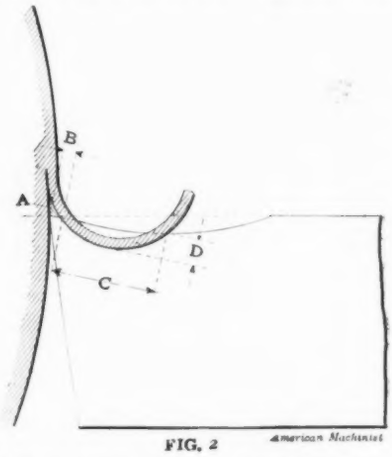


FIG. 2

A, ridge; *B*, unworn part of edge; *C*, width of part ground away; *D*, depth of part ground away.

CUTTING ACTION OF HIGH-SPEED STEEL.

*Extracted and translated from *Stuhl und Eisen* by E. P. Buffet.

†I here render the word *angelaufen* as referring to the formation of tempering colors. It has, however, a variety of meanings associated with tapering, blunting, fusing, oxidizing, etc.—*Trans.*

on the top of the tool between the edge and the worn part can be kept as wide as possible, as in Fig. 1, the longer the cutting efficiency of the tool can be maintained. In other words, the greater the power of resistance of a rapid cutting tool against grinding away on the top by the separating chips, the longer will it last.

[At page 857, Vol. 19, we gave some illustrations of the form assumed by tools when cutting the screw of the Sprague-Pratt elevator which was precisely like the one sketched in the illustrations. Ordinary tool steels would not answer for working the high carbon steel of which the screws were made and the tools shown were made from an imported German steel made by Eicken & Co. This, of course, was not one of the modern high-speed steels, but our recollection is that it was a tungsten steel from which the modern steels originated, and it therefore belongs to the same class. We should be glad to have our readers inform us if they have observed the action described as a characteristic of high-speed steels.—Ed.]

Technical Publications.

"Methods of Chemical Analysis and Foundry Chemistry." Second edition. By Frank L. Crobaugh. 109 5x6¼-inch pages. Published by the author, Cleveland, Ohio. Price, $2.00.

This manual is intended for both foundry chemists and foundrymen. It is divided into two parts, of which the first gives the methods for determining the contents of iron, sulfur, carbon, phosphorus, etc., which the author has found most satisfactory, and the second gives the proper constituents of castings for various purposes with the determination of the mixtures necessary to obtain the desired results.

"An Elementary Text Book on Machine Design." By C. L. Griffin. 183 6½x9½-inch pages, with 82 illustrations. Published by the author, Syracuse, N. Y.

Part I of this book is a reprint of some of Mr. Griffin's previous writings which have already been favorably noticed in these columns. The object of this part is to show the student the methods by which machinery is designed—that is, how the problem is attacked and carried through, and this it fulfills in an admirable manner. Following the general treatment of Part I, Part II takes up in detail the discussion of a few machine elements—belts, pulleys, shafts, gears, couplings, bolts, keys, bearings, etc.

"Machine Tool Drive." 42 6x9-inch pages with diagrams, tables and inset cuts. The Westinghouse Electric & Manufacturing Company, Pittsburg, Pa.

While this handsomely printed pamphlet is essentially trade literature it is in no sense a catalog, and as it is a serious discussion of the machine-tool driving problem we give it a notice in this column. After a general discussion of the advantages and economies of motor driving of machine tools, it undertakes a critical comparison of the four-wire six-voltage and the three-wire balanced voltage systems of speed control for machine-tool driving, the comparison being unfavorable to the former system. Whether they agree with the deductions or not, machine-tool builders will be interested in and will profit by a reading of this presentation of the case.

"A Treatise on the Principles and Practise of Dock Engineering." By Brysson Cunningham. 559 6x9-inch pages with 468 text cuts and 34 folding plates. Charles Griffin & Co., London; J. B. Lippincott Company, Philadelphia.

This is one of those high-grade treatises upon engineering specialties which come occasionally from the pens of English engineers and which from their special character and obvious high cost lead one to wonder how the enterprise of author and publisher can be repaid. The book deals with dock design, constructive appliances, materials, dock and quay walls, entrances, locks, wharfs, piers, gates, caissons, sheds, warehouses, graving (dry) docks and working equipment. There is a great wealth of data regarding existing dock systems and the book is in every respect a model engineering treatise.

"The Indicator Handbook." Part II—The Indicator Diagram; Its Analysis and Calculation. Second Edition. By Charles N. Pickworth. 134 5x7-inch pages, with 150 illustrations. Emmott & Co., Manchester; D. Van Nostrand Company, New York.

The first part of this book, published as a separate volume, treats of the construction and application of the indicator, while, as indicated by its title, the present volume discusses the analysis and calculation of the diagram. The treatment is very complete and includes the combining of diagram from compound steam engines, diagrams from gas and oil engines and those from air compressors and pumps. An appendix gives a novel method of finding the index of expansion curves and describes the Mathot explosion and pressure recorder for internal combustion engines which is finding considerable use in England.

Personal.

Geo. L. Markland, Jr., was elected treasurer of the Cleveland Gear Works on July 16.

Edward C. Collins has resigned his position as foreman with the Taunton Locomotive Manufacturing Company, of Taunton, Mass., to accept the position of general foreman with the Campbell Printing Press & Manufacturing Company in its Taunton shops. Mr. Collins has been connected with the locomotive company as foreman for fourteen years.

At Springfield, Vt., July 31, John W. Hartness celebrated the seventy-fourth anniversary of his birth. Mr. Hartness, who will be best known to our readers as the father of James Hartness, the inventor, builder and pusher of the Jones & Lamson flat turret lathe, was born in Albany, N. Y., and in early life worked for one of the constituent companies of the New York Central Railroad. He became a master mechanic, and later was for some years in Cleveland, Ohio. He gave up active business in 1896. Of his three living sons, John A. is treasurer of the English branch of the Jones & Lamson Company, and Robert B. is in New York city. Mr. Hartness sent around to his friends an attractive birthday card, in which he announces that he is "still ambling along."

Obituary.

Isaac Newton Topliff, a widely known carriage hardware manufacturer, died at Cleveland, Ohio, August 7, seventy-one years old.

John M. Jones, said to be the oldest printing press manufacturer in the United States, died at Palmyra, N. Y., August 3, eighty-five years old. He patented one of the earliest, if not the first, typewriter in 1855.

David J. Mattack, who had been connected with the foundry of the Cramp Shipbuilding Company fifty-six years and most of the time as superintendent, died suddenly July 25, seventy-three years old. Mr. Mattack had been for twenty years a member of the American Society of Mechanical Engineers.

"Golden Rule" Jones.

The late Samuel M. Jones, whose death we have previously noted, and who was a manufacturer in Toledo, Ohio, and mayor of the city for several terms, was such a unique character that he was quite generally misunderstood. We confess to a very hazy knowledge of him during his lifetime, but we find in the *Municipal Journal and Engineer* a very interesting and discriminating account of him as follows:

If it be the province of genius to do those things which other men have merely thought of doing, or to crystallize into practise theories hitherto regarded as Utopian, then the late Samuel M. Jones, sometime mayor of Toledo, was undoubtedly a genius.

The greatest legacy that Mayor Jones left to the world and to his children was the example of his life and the purity of his character. That he was not without guile is evidenced in the many quaint anecdotes told about him wherein he evinced a shrewd but homely diplomacy in the handling of men. He once obtained a postage stamp without parting with the necessary collateral, by the exercise of quick-wittedness, and on another occasion raised some woefully needed money for himself and his impecunious companions by collecting toll at a bridge that belonged to the State. These harmless little pecadilloes are mentioned lest,

in our admiration for the sturdy honesty of his character, we are led into the error of concluding that he was not essentially human.

It would be difficult to find a historical parallel for the character and career of Mayor Jones. From the point of view of humor and for sheer quaintness and indifference to the claims of dignity, he had much in common with the most unique of the civic magistrates of fiction—the Sancho Panza of Cervantes. Looking to higher and nobler examples, he veiled his inexorable steadfastness of purpose under a superficial gaiety and homely humor not unlike that of Lincoln, and in absolute brotherhood with his inferiors in wealth and ability, he deported himself in a manner similar to one of our ablest men of genius on the roll of history—Peter the Great.

Although born in Wales, Mayor Jones was a finished product such as only this country could produce. He came from that section of Great Britain which gave to the world the indomitable Stanley and the greatest of actor-managers—Irving. It is more than possible that in his veins ran much of that Celtic blood which flows around the world and enriches every shore that it touches. A rare personality was his—so strong that at his death it called forth formal tributes of respect and love from such widely divergent associations as the Epworth League, the University extension and the Bartenders' Association.

In politics, Mayor Jones was a law unto himself. Therefore, while he was a politician in the higher sense, he was not a conventional one. An idealist, whose lack of early training and scholarship was the cause of his many idiosyncrasies, it was difficult for him to reason from cause to effect, nor did he arrive at conclusions by processes of logical reasoning. But when he came before his own people and asked for their votes, his strong, wholesome, homely personality won for him their love and their acclaim and they hailed him after the manner of Kipling's Kim, as a friend of all the world.

A lively account of some of his campaign methods was given some years ago by Dr. Washington Gladden in the *Outlook*, from which we quote a few sentences:

"Democracy, as he understood it, rests on Christ's law of love, and this is what he preached up and down the streets of Toledo, in season and out of season. It must have been rather a bewildering moment to the average politician when Mayor Jones stepped upon the platform at the last meeting before the election, in the great armory packed with voters, amid a tumult of applause and cries of 'What's the matter with the Golden Rule?' 'What's the matter with Brotherhood?' It was a notable speech which followed. Mayor Jones declared that he had sought to discharge the duties of his office in such a way as to bring the blessings of good government to all the people. He spoke rather sadly of the opposition of some whose friendship he might have reckoned on. 'It is not pleasant,' he said, 'to be counted among the disreputable, to be classed as a "demagogue" and a "dangerous man"; but there is comfort in the reflection that men at whose feet I would count it an honor to sit, have been called demagogues.'"

Much criticised by the ultra-conventional and conservative during his public lifetime, none were found so base or so bitter as to malign him after he had laid down the burden of life. It is pleasant to read of him in one of the most conservative of the Eastern journals, whose principles were the very antithesis of those of the dead mayor, that "he lived up to his principles, and, besides paying his employees as good wages as he could, he less than three months ago gave them stock in the Golden Rule Trust, as his company is now called, to the value of $10,000. In giving it to them, he said: 'You may do with it exactly as you please. I only hope that you will keep it intact and use the income in the spirit of the Golden Rule, but there are no strings to it.' He said of himself, in a sort of biography issued as a campaign document in his gubernatorial campaign, that he raised wages and shortened hours both in his factory and in his oil fields, declared 5-per-cent. Christmas dividends for his employees, and gave then a week's vacation every year. He established Golden Rule Park, where good music and good speaking are furnished the year around.

Mayor Jones believed with Shelly that men need both work and leisure and that too much of either is not wholesome nor desirable. He tried as best in him lay to improve labor conditions. He declared that the "going wages" rule should not govern his factory, but, on the contrary, that "every man is entitled to such a share of the product of his toil as will enable him to live decently, and in such a way that he and his children may be fitted to be citizens of the free republic, should be the rule governing the wages of our establishment."

Regarding his theories of municipal government, Mayor Jones wrote and spoke a great deal. If his mental equipment had measured up to his high moral worth, he might have evolved a lasting improvement upon existing systems. It is, however, without point to criticise his political or social theories. He was the author of two complete books, apart from his notes and addresses, but it is not likely that they will long attract attention. The grandeur of his character overshadowed his mental attainments, and it is as a man and not as a theorist that he will live in the hearts of the people.

Not only was the Golden Rule the political platform on which the late mayor stood, but it was the precept on which he tried to base every act of his life. Hypocrisy or humbug had no part in his broad and expansive nature. He was *sui generis* in that he dominated his fellows by sheer force of character rather than by argument, and by love rather than force or cunning. His life was by no means a bed of roses, and from the time of his early struggles for a foothold on the platform of prosperity, up to the period when he had fulfilled a measure of his ambition, his actions were misconstrued by a great many of his fellowmen. But

"Like some tall cliff that rears its awful form,
Swells from the vale and midway leaves the storm:
Tho round its base the lowering clouds may spread,
Eternal sunshine settles on its head."

The Cost of Living.

In the eighteenth annual report of the Bureau of Labor is given the result of an extensive inquiry into the cost of living in the United States since 1890. The inquiry into retail prices is the first extended investigation covering a long period which has ever been made in this country. To conduct this branch of the inquiry the books of 814 retail merchants were consulted in the various localities. Prices were taken for each month thru the thirteen years from 1890 to 1903, covering thirty articles and several grades of each. The inquiry covers the cost of living of 2,567 families, of whom 1,415 lived in the North Atlantic States, 721 in the North Central States, 219 in the South Atlantic States, 122 in the South Central States and 99 in the Western States. The families consisted of an average of 5.31 persons and the average income for the year 1901 was $827, the average annual expenditure for all purposes was $768, of which $326, or 42 per cent., went for food. The quantity of fresh beef, for which $50 was expended, was 249 pounds, making the cost per pound 14 cents. Fresh pork cost $14; poultry, $8; salt pork, $13; fish, $9; eggs, $16; milk, $21; butter, $28; cheese, $2.62; coffee, $10.74; sugar, $15.75; tea, $5.30; flour and meal, $16.76; bread, $12; potatoes, $12.93; fruit, $4.12; lard, $9.35; miscellaneous vegetables, $16, and other food not enumerated, $20. The lowest average price of food from 1890 to 1903 was in 1896, when it was 95.5 per cent. of the average price from 1890 to 1899. The highest price was in 1902, when it was 110.9 per cent. of the average price for the period.

The main conclusion of the inquiry, as stated in the report, is that the average cost of food for a family of five persons is now 15 per cent. above the average, the year of lowest cost having been 1896. The *hourly* wages in 1903 were 15 per cent. higher than for the period 1890 to 1900. There has been a reduction in the hours of work while the aggregate amount earned yearly has not increased.

Business Items.

The Philadelphia Gear Works, Inc., Philadelphia, Pa., are quite busy, and on August first had orders ahead to keep their plant running for over six weeks.

The Cleveland Gear Works, Inc., of Cleveland, Ohio, have added an automatic Whiton gear-cutting machine to their equipment, also a new drill press, shaper and several other tools, which will nearly double their manufacturing facilities. They have adopted the Zenith high-speed steel for turning, etc., after experimenting with several foreign and domestic brands of high-speed steel.

The Sprague Electric Company has for many years been identified with the manufacture and installation of electric motors for operating ventilating fans and blowers. Among recent installations are the motors to drive the ventilating apparatus in the Chicago Post Office and the New York city and Brooklyn public baths. In the West Forty-first street and East Seventy-sixth street public baths, in New York, there will also be installed two 30- and two 25-kilowatt Sprague engine type generators.

The International Steam Pump Company—Worthington division—has secured a contract for the complete electric pumping equipment of the extensive Parral mines of Pedro Alvarado, the Mexican Silver King. Two complete sets of both station and sinking pumps of special high-lift type, operating under a 750-foot head, are to be supplied. The pumps will be direct connected to special waterproof motors of 130 horse-power each. The company also has several orders in hand for smaller turbine pumps to go to mines in other parts of Mexico.

Manufacturers.

F. F. Giesler proposes to build a pearl button factory at Muscatine, Ia.

The Knoxville (Tenn.) Slate Company may build a slate mill in the South.

The Wheeling & Lake Erie will rebuild its car shops burned at Canton, O.

Beverly, Mass., is taking measures relative to the erection of a pumping station.

The Philadelphia (Pa.) Quartz Company may establish a large plant at Chester.

Armour & Co., Chicago, Ill., are about to build a large fertilizer plant in Florida.

The Oliver Machinery Company, Grand Rapids, Mich., thinks of erecting a large factory building.

The Duluth (Minn.) & Iron Range Railroad is planning to replace shops burned at Two Harbors.

The plant of the Chief Husker & Shredder Company, of Colfax, Ill., was to be sold by the sheriff August 10.

Secretary Teck of the Chamber of Commerce, Bellingham, Wash., is in touch with a casket factory project.

An addition is to be built to the Delaware Brick Company's plant, at Point and Elm streets, Camden, N. J.

The Bower & Teets Manufacturing Company, machinist, Lehighton, Pa., is building a 40x120-foot foundry.

The Larson Lumber Company, Bellingham, Wash., will rebuild the shingle department of the mill at Lake Whatcom.

It is stated at Cincinnati, O., that a large factory is to be erected in Norwood for the Haney Ventilator Company.

Plans for a large new plant for the Roach & Kienzle Sash & Door Company, Kansas City, Mo., are being prepared.

M. Schrayer's Sons & Co., Chicago, Ill., tinware and hardware, will build a five-story, 75x179-foot warehouse and factory.

F. E. Bowers, of Nashville, Tenn., is organizing a company to build a brass foundry and machine shop in West Nashville.

Orville Carpenter, reel manufacturer, Pawtucket, R. I., has received a permit for a manufacturing block, two stories, 40x75 feet.

The Andrews Wire & Iron Works, Rockford, Ill., is enlarging its plant. A power plant will probably follow the present addition.

A large addition is being, or to be, built for R. Wallace & Sons Manufacturing Company, silver and plated ware, in Wallingford, Conn.

G. S. W. Brown has gone from Ilion, N. Y., to Mason City, Ia., in order to manufacture a patent combined refrigerator and ice-cream freezer.

A new brick building will be erected on the site of the old foundry of the York (Pa.) Safe & Lock Company as an addition to the safe works.

The Lovell Manufacturing Company, Erie, Pa., manufacturer of clothes wringers, rat and mouse traps, is starting to erect a $14,000 building.

J. A. L. Horton, 217 Commonwealth Building, Allentown, Pa., projects an enterprise for the manufacture of electro-surgical apparatus, etc.

Work has been begun on a new factory building for P. B. Canfield, gas engine manufacturer, Binghamton, N. Y. It will be 40x80 feet, two stories.

The Cedar Falls (Ia.) & Marion City Railway Company is to build a new car barn, with machine and blacksmith shops and car-building facilities.

Plans are being prepared for the heating, lighting and power plant to be built for the Virginia State buildings. An appropriation of $25,000 was made.

It is rumored that the new Lake Erie & Pittsburg Railroad will spend $1,000,000 in building terminals, shops, ore hoists and dockage at Lorain, O.

Arrangements have been concluded whereby the St. Mary's Wheel & Spoke Company, of St. Mary's, O., moves a large plant from there to Prescott, Ark.

The Cannon Pump Manufacturing Company, of Waycross, Ga., is building a plant at North Birmingham, Ala. It will manufacture deep water pumps.

A packing plant is advocated at Salt Lake City, Utah, by a Mr. Leary. President Houston of the Real Estate Exchange has information about the project.

Plans are being made for an addition to the plant occupied by the Specialty Weaving Company, Shelton, Conn., allowing the placing of some fifty more looms.

J. P. Hettinger, Chicago, Ill., is preparing plans for a three-story, 38x100-foot machinists' specialty factory, to be built at 163 Ward street; owner not stated.

The general superintendent of the Frisco is quoted as stating that it will be but a short time before the road will build a new machine shop in Sherman, Tex.

The Illinois Foundry & Machine Company, which is to have $50,000 capital stock, has purchased land on State street, Granite City, Ill., and will at once erect a plant.

If all the plans are carried out, the Keystone Company, implements and foundry, Rock Falls, Ill., will make great enlargements before the end of another year.

It is reported that a site has been secured by the Grand Rapids Foundry Company, Grand Rapids, Wis., for the erection of a machine shop, foundry and pattern house.

The Hammond & Armount Company will manufacture at Rockford, Ill., a buttonhole-cutting attachment for sewing machines. The device is that of O. E. Hammond, Belvidere, Ill.

Three men of Barre, Vt.—George Findlater, John Phillips and Ed Taylor—have bought a site at Davenport, Ia., and will engage in finishing and polishing granite and fine stone.

At a meeting in Toronto, Ont., of the directors of the Corundum Refiners, Ltd., plans were accepted for a plant of 100 tons daily capacity, to be built at Palmer Rapids, Renfrew County.

The Brown & Sharpe Manufacturing Company, Providence, R. I., has received a permit to erect a six-story brick and iron building, 63x114 feet, to be used for manufacturing purposes.

P. H. Westgaard, Gainesville, Fla., has sold the Gainesville Machine Works to L. P. Larson, formerly of Fitzgerald, Ga., who will equip a foundry and increase the capacity of the machine shop.

The J. I. Case Threshing Machine Company, Racine, Wis., will erect a large building. We understand that it is intended for a machine shop and engine erecting room, tho this is not positive.

The directors of the Morse Iron Works held a meeting at the rooms of the Erie (Pa.) Builders' Exchange, when propositions for furnishing sites for the erection of the new plant were canvassed.

An insulator manufacturing plant is to be built at once at Lima, N. Y. W. D. Newton, of Rochester; M. E. Burke, of Victor, and E. W. Lathrop, of Boston, Mass., are at the head of the movement.

At the International Paper Company's mills, Berlin, N. H., improvements are under way, and it is reported that the machine and pipe shops may be moved to more convenient locations in a new mill.

The contract has been let for a new building at the works, in Cleveland, O., of the Schneider & Trenkamp division (brass founder and manufacturer of vapor stoves) of the American Stove Company.

The Commercial Club of New Decatur, Ala., is corresponding with parties in Ohio relative to the location of a factory for the manufacture of boilers and engines. They seek a location in the South.

The Vandyck-Churchill Company has been incorporated at Albany to take over the business of the J. R. Vandyck Company, 8 Dey street, New York. There is no other change in the affairs of the company.

The Southern Electric & Manufacturing Company, chartered in Delaware, will build a plant at Anniston, Ala., to make a general line of small electrical goods. W. L. Goodhart is secretary and treasurer.

The Board of Public Works, Milwaukee, Wis., has decided to advertise, for the third time, for bids for a 20,000,000-gallon pumping engine. An eight-hour-day labor clause is said to have caused the trouble.

The Illinois Tunnel Company will erect at Chicago, Ill., a 404x699-foot building, five stories below, seven above ground, for terminal and storage purposes. Big electric elevators and conveyors will be installed.

The Vulcan Manufacturing Company, Winsted, Conn., is examining, with a view to manufacturing, a device for continuous cylinder record phonograph playing. It was patented by a New Haven man named Benton.

The Emerson Steam Pump Company has removed its general office from Washington, D. C., to its factory at Alexandria, Va. All communications should be addressed the Emerson Steam Pump Company, Alexandria, Va.

The Standard Engineering Company, Ellwood City, Pa., maker of bolt threaders and

pipe threading and cutting machines, has appointed Mr. A. A. Schaefer as New York sales manager, with office at 150 Nassau street.

A party of business men of South Milwaukee, Wis., have invested $25,000 in Mississippi timber lands. They will erect a sawmill on the property. J. H. Morgan, E. J. Henning and Fred Koch are officers or directors.

The plants of the American Clay Working Machinery Company have been ordered by Judge Wing in the United States circuit court to be sold. The company has two factories, one at Bucyrus, O., and the other at Willoughby.

Richards & Smith, architects, Chicago, Ill., have been making plans for a school supply factory that is to be built at Chicago Heights. Metal chairs, globes, blackboard erasers, etc., will be manufactured, and probably desks added later.

The German-American Foundry Company has been organized to conduct a general foundry business at Boonton, N. J. The capital stock is $25,000. Henry Krueger, Oscar Rohland and others, all of Boonton, are the incorporators.

The Interstate Steel Company, an outgrowth of the Weyburn Company, Rockford, Ill., has been incorporated with $65,000 capital stock, to manufacture a soft center steel, etc., and the erection of a new 60x100-foot building is progressing.

The Riverside Brick Company has incorporated with a paid-up capital of $44,000. The incorporators are Birmingham, Ala., men, as follows: T. C. Thompson, W. H. Thompson and B. A. Thompson. The company will erect a plant.

The firm of Finch, Pruyn & Co., Glens Falls, N. Y., has been incorporated with a capital stock of $3,000,000 to manufacture pulp and paper. The concern will construct a large plant there and will enlarge its lumber mills in that district.

The Attachable Ball-Bearing Hub Company, of Vancouver, Wash., has decided to locate in East Portland, Ore.; has leased a building and ordered machinery. After getting started the company will secure ground and put up a large factory.

It is stated at Mexico City that Miguel M. Navarro has obtained a concession to utilize 3,000 liters of water per second from the river Los Molinos or Nexapa, in the districts of Atlixco and Cholula, in the State of Puebla, to generate electric power.

Land has been acquired in Harrison and Kearny, N. J., for the Steel Company of America, capitalized at $3,000,000. Albert H. Henderson and A. H. Smith are the incorporators named in the papers. The real backers are not generally known.

The Dolese & Shepard Company, Chicago, Ill., crushed stone, granite and lime, has purchased the works of the Gary Stone Company at Gary, on the Santa Fe railway, just south of Riverside. The company is about to build a large stone-crushing plant.

It is stated at Rossland, British Columbia, that the Le Roi Company is preparing for the erection of concentration works. This requires the sanction of the stockholders. Le Roi, where the company probably has quarters, is a place not far from Rossland.

Jamestown, N. Y., is to have a new industry, the manufacture of soft rubber articles. The company will have a capital of $100,000. Among those interested from out of town is George W. Quinlan, of Buffalo, late of the Vim Cycle & Hardware Company.

Globe Iron Works Company, manufacturer of the White gasoline engine, Minneapolis, Minn., has let the contract for its new buildings at Menominie, Wis., and they are now in course of construction. The company hopes to occupy them by the middle of October.

The American Car & Foundry Company, St. Louis, Mo., is taking over the plant of the Southern Car & Foundry Company, at Binghamton, in or near Memphis, Tenn., and will put it in shape to be started up. It is understood that the Gadsen, Ala., plant, also, has been acquired.

W. T. Owen, secretary of the Anniston (Ala.) Commercial Club, has secured the incorporation (in Washington, D. C.) of a $1,000,000 concern, to be known as the Standard Glass Company, which will make a lamp chimney and other products, presumably building a plant at Anniston.

A new building to cost $50,000 or $60,000 will be erected by the Merkel Motor Company, Milwaukee, Wis., which has recently incorporated for enlarged business. The equipment will be in addition to the sum mentioned. The company will place on the market automobile and gasoline boat engines.

It is learned at Oakland, Cal., that the American Magnesite Company, address not given, has sold bonds amounting to $500,000 to the California Title Insurance & Trust Company, of San Francisco. The money realized will be used in developing magnesite claims in Alameda and Santa Clara Counties.

There is to be another power company operating in Shasta County, Cal., if plans are carried out. J. E. Frick, of Berkeley, has secured 40,000 inches of water near Redding. He says that San Francisco people are interested with him, and that they will form a company, install a plant and furnish light and power to many cities and towns.

Men of different Western cities, including Mayor Hughes, of Fond du Lac, have received letters from F. Irving Dow, of Buffalo, N. Y., who talks of establishing a large motor, engine and gasoline automobile factory. Secretary Hathaway, of the Board of Trade, Kalamazoo, Mich., has received a similar letter, probably coming from the same source. Mr. Dow's company's address is 425 Northumberland street, Buffalo.

The plant and machinery of the Florence (Ala.) Machine Shops have been sold to George L. Hexie and Allen H. Kells, of Adrian, Mich. The shop has been converted into a manufactory of clay-working machinery, friction clutches and other machines upon which these gentlemen have patents. They expected to have the plant in operation by August 1.

The National Scale Company, Beaver Falls, Pa., is a new industry which will be started by Beaver Falls business men. The names of the incorporators are John Reeves, John T. Reeves, John H. Ohnsman, Jacob Houser, H. W. Reeves and J. M. May. Little is given out regarding the matter, but it is understood that a local factory building will be used in their work.

A most elaborate cane-crushing plant has been commenced for the great Makaweli sugar plantation of Hawaii. The contract for the work is said to have been awarded to the Honolulu Iron Works Company in competition with the steel centers of the East. It will be a twelve-roller mill in connection with revolving cane cutters and the Krajewski-Pesant cane crusher.

The Adrian (Mich.) Steel Casting Company, capitalized at $30,000, has organized by electing the following officers: President, Charles E. Sutton, Toledo, O.; vice-president, Dr. G. B. M. Seager; secretary and general manager, W. N. Swift; treasurer, E. N. Smith. The company will use the process invented by A. H. Davies, one of the stockholders. It will erect a plant at once.

It is stated at Joliet, Ill., that the certificate of incorporation of the Buckeye Engine & Foundry Company has been filed; capital $50,000. It is organized to buy, sell, build and construct gas and gasoline engines and to buy, sell and manufacture engines, machines, manufacturers' tools, etc. The stockholders are: Fred Bennitt, Peter Michels, George J. Buckeye, Jacob Buerlein and James A. Raymond.

The O'Rourke Engineering & Construction Company, which firm has the contract for building the Pennsylvania Railroad tunnel under the Hudson River, has placed the order with the Ingersoll-Sergeant Drill Company for two central compressed air power plants, to be located at New York city and Weehawken, N. J. This order includes six 36-inch stroke Corliss air compressors, each of 3,890 cubic feet capacity.

The Bessemer Foundry Company was recently incorporated in Delaware, and has applied for a charter in Pennsylvania. The business is to make iron castings, and the works are to be at Grove City, Pa. The capital stock is placed at $12,000, and the incorporators are Benjamin Spearman, of Sharpsville; J. J. Spearman, of Sharon; J. M. Albin, W. H. Christy, C. F. Elbridge and Samuel Helfern, of Grove City, and others.

About two miles from Lincoln Park, N. J., the Pompton Fuel & Developing Company has erected several buildings and most of its machinery. The compress has been imported from Germany. The company is to erect a carrier by which to convey the peat from the bog to the factory. The exploitation of peat bogs seems to be a rising industry. At Manito, Ill., the material is being dug for making a commercial fertilizer, it is stated.

At Pittston, Pa., three allied new industries are in present and prospective organization. They are the Alpine Brewing Company, the Alpine Ice Company and the Pittston Electric Light & Heat Company. The latter is to be capitalized at $250,000 to furnish light and heat to the residents of Pittston, West Pittston and all the surrounding towns. Edward Rutledge, representing the parties interested, has purchased land for the plants.

The Hendricks Manufacturing Company, Waynesboro, Pa., has purchased from the Geiser Manufacturing Company all the damaged machinery that was in the Metcalfe plant, Quincy, which was destroyed by fire, May 28. The purchase is made up of twenty machines, consisting of lathes, drills and milling machines. The Hendricks Company anticipates the enlargement of its shops in the near future, when all of the recently purchased machinery can be put into operation.

The Driggs-Seabury Ordnance Corporation has been organized to manufacture ordnance, rapid-fire guns, projectiles and gun carriages. The plants will be at Sharon, Pa. The capital stock is to be $500,000. John Stevenson will be president; Stephen Peabody, of New York, vice-president, while Senator William Flinn, of Pittsburg, is one of the largest stockholders. The business of the Driggs-Seabury Company, near Philadelphia, has been acquired, and this will form the nucleus of the new concern.

A company controlled by members of the Brodhead Contracting Company, of Wilkesbarre, Pa., proposes to establish in Greenville, Pa., or vicinity a plant for the manufacture of glass bath tubs and sanitary appliances, kegs, vats, burial caskets, etc. The capital stock will be $1,000,000. Between 150 and 200 men will be employed at the outset. The American rights for the manufacture of glass articles, under the process of Herr Seivert, of Dresden, Germany, have been secured. The main building will be 300x100 feet.

R. H. Beach, who recently severed his prominent connection with the General Electric Company, after seventeen years' service, has arrived at Guadalajara, Mex., and will devote his attention to the iron mines, mills and foundry at Ferreria de Tula, State of Jalisco. Mr. Beach and George Townsend, an Indianapolis capitalist, have leased the properties for ten years, with an option to purchase. They are preparing to build up one of the largest manufacturing enterprises in the republic. It is proposed, among other things, to establish a steel plant.

It is stated at Iola, Kan., that the King Gas Engine Company has been organized, and work was to begin on the erection of the plant by the first of August. The purpose is to build the King gas and gasoline engine and the King gasoline locomotive, which latter is for mines and other tram work. The equipment of the plant will be such as is necessary to build gas engines up to 250 horse-power. The company will have an office and sales room in Iola and a sales agency in Kansas City. These engines are said to have been in operation for about six years.

New Catalogs.

Massachusetts Tool Company, Greenfield, Mass. Catalog No. 5 of precision tools, including micrometers, rules, gages, calipers, etc. Illustrated. 4x6, pp. 96, paper.

George Gorton Machine Company, Racine, Wis. No. 1 engraving machine, described and illustrated. A number of examples of typical work done with this machine are shown. 6x9, pp. 16, paper.

Mutual Manufacturing Company, Bridgeport, Conn. Illustrated catalog and price list of mounted and unmounted knife switches, rosettes, wire connectors and other electrical goods made by this company. 4x8, pp. 22, paper.

The Link-Belt Engineering Company, Philadelphia, Pa. "Renold Chain," an illustrated catalog showing the design in detail of Renold silent chain gear and its application to various machine-tool drives. The booklet will be of value to those interested in chain drives. 3¾x7½, pp. 34, paper.

Standard Machinery Company (successors to Mossberg & Granville Manufacturing Company), Providence, R. I. Four illustrated catalogs showing the products of this company. The catalogs cover, respectively, drop presses, rolling mills, power presses and miscellaneous machines and tools. 6x9, paper.

Gisholt Machine Company, Madison, Wis. Gisholt tools. We have received from this company a series of bulletins of Gisholt horizontal boring mills, vertical boring and turning mills, turret lathes, universal tool grinders, etc. The distinctive features are pointed out and described. Illustrated by fine halftones. 7½x9½, pp. 10, paper.

Miscellaneous Wants.

Advertisements will be inserted under this head at 25 cents a line each insertion. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

Caliper cat. free. E. G. Smith, Columbia, Pa.

Punches & dies. Wal.M.Wks.,Waltham,Mass.

Will buy or pay royalty for good patented machine or tool. Box 282, AMER. MACH.

Wanted—Copy of AMERICAN MACHINIST, Jan. 30, 1902, issue. BOX 236, AM. MACH.

Light mach'y to order; model work; rubber molds. J. W. Weir, Bridgeport, Conn.

Light and fine mach'y to order; models and elec. work specialty. E. O. Chase, Newark, N. J.

Automatic machinery designed; working drawings. Geo. M. Mayer, M. E., 1131 Monadnock, Chicago, Ill.

Automatic machinery designed and constructed by the Wellman Sole Cutting Machine Co., Medford, Mass.

Wanted—Second-hand vertical boring mill, 60 or 72 in.; must be in good condition. Ft. Scott Mfg. Co., Ft. Scott, Kan.

Wanted—Address of —— Heeson, inventor of the Heeson rocking grate bar. Address F. S., care AMERICAN MACHINIST.

Auto. machinery of all kinds designed and built; hardened and ground work, flat or circular. Wiebking, Hardinge & Co., Chicago.

Will purchase, or manufacture on royalty, patented machine of merit. Address, with full particulars, Box 176, AMER. MACHINIST.

A director of methods for increasing machine shop output solicits engagements; vast experience; excellent record. Box 196, A. M.

Addressing machines without type; high speed; run by motor or foot power; write for the picture book. B. F. Joline & Co., 123 Liberty st., New York.

Wanted—By fully equipped and modern machine shop, special machinery or machine parts to build by contract or day work. Address Ingle Machine Co., Rochester, N. Y.

For Sale.

For Sale—Five "Hisey" Electrically driven hand drills, 220 volt; in perfect condition, and will sell at a sacrifice. H. H. Franklin Mfg. Co., Syracuse, N. Y.

For Sale—1 Farrell Foundry hydraulic pump and press; 800 tons; cost $1,950; will sell very reasonable; perfect condition. H. M. Crowell Mfg. Co., 6th ave. and 13th st., Newark, N. J.

Wants.

Situation and Help Advertisements only inserted under this head. Rate 25 cents a line for each insertion. About six words make a line. No advertisements under two lines accepted, and no advertisements abbreviated. The cash and copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded. Applicants may specify names to which their replies are not to be forwarded; but replies will not be returned. If not forwarded they will be destroyed without notice. Original letters of recommendation or other papers of value should not be enclosed to unknown correspondents. Only bona-fide situation want or help want advertisements inserted under this heading. Agency advertisements must be placed under Miscellaneous Wants.

Situations Wanted.

Classification indicates present address of advertiser, nothing else.

CANADA.

A1 brass foundry superintendent or foreman, at present engaged, desires position; thoroughly up to date; can handle men; practical mixer and molder. Address "Competent," care AMERICAN MACHINIST.

ILLINOIS.

M. E. college graduate, draftsman and designer of steam engines and tools, wants position. Address S. H., General Delivery, Chicago.

Engineering salesman, technical graduate, desires position; experienced in Corliss engines, pumps, air compressors, boilers, elevating and conveying machinery. Address Box 230, AMERICAN MACHINIST.

INDIANA.

Mechanical draftsman, technical graduate, shop experience, desires position. Box 221, AMERICAN MACHINIST.

MASSACHUSETTS.

Mechanical engineer, with extensive shop experience, desires permanent, responsible position which requires technical training as well as practical knowledge; salary not less than $1,300. Box 229, AMERICAN MACHINIST.

Mechanical draftsman and practical machinist, designer of automatic and special machinery, tools, jigs, fixtures, etc., desires position as superintendent, assistant superintendent or general foreman; present employment chief draftsman. Box 232, AM. M.

NEW JERSEY.

General draftsman and mechanical engineer wants position. Box 208, AM. MACH.

Young man, 22, commercial technical graduate, machinist, toolmaker and erecting engineer, desires position as draftsman; excellent recommendations. Box 222, AM. M.

NEW YORK.

Young man, 26; 10 years' machine shop experience, tools, dies, jigs; references. J. J. K., Box 219, AMERICAN MACHINIST.

Wanted—Position as general foreman or assistant superintendent, by a thorough, practical mechanic. Box 202, AMER. MACH.

Mechanical draftsman, graduated, 5 years' shop and 5 years' office experience, wants position. Box 235, AMERICAN MACHINIST.

A1 draftsman and designer of gasoline engines and automobiles desires to change; college graduate; age 30. Box 228, AM. MACH

Mechanical draftsman, 5 years' experience in shop and drawing-room, good, all-round man, wants to make a change. Box 214, AMERICAN MACHINIST.

Manager's assistant; 10 years' factory office experience; cost accountant; purchasing agent; correspondent; systematizer, etc. Box 223, AMERICAN MACHINIST.

Mechanical engineer, technical graduate, seeks position; 8 years' experience, machinery, concrete, automobiles; references. Address Box 225, AMERICAN MACHINIST.

Position as superintendent or general foreman, by a thoroughly up-to-date mechanic, 37, with 20 years' experience on machine tools, interchangeable machinery and automobile manufacture. Box 220, AM. M.

Fourteen years' experience, covering machine tools, rolling mills, special machinery and electrical machinery, as engineer, designer and superintendent; member A. S. M. E.; open for engagement. Box 213, A. M.

Experienced man as machinery salesman, office or shop manager; has worked at general and special wrok, and is acquainted with the trade, also familiar with purchases, correspondence, specifications, etc. Box 226, AMERICAN MACHINIST.

Mechanical engineer will be open for engagement in September as superintendent or master mechanic; technical education and large experience in the manufacture of small interchangeable machinery, sheet metal goods, etc. Address Box 190, AMER. MACHINIST.

PENNSYLVANIA.

An experienced designer of special machinery, tools and fixtures for manufacturing purposes wants work along this line with a progressive concern. Address Box 224, A. M.

A practical machinist, with technical education, at present engaged, desires change; 35 years of age; 15 years' experience; the past 8 years as manager, buyer and chief designer of manufacturing plant building engines, boilers, sawmill machinery, etc.; salary $2,500. Address E. H., care AM. MACH.

WEST OF MISSISSIPPI.

A practical machinist and graduate mechanical engineer, with 8 years' thorough practise, wishes position as instructor or assistant professor; references furnished. Box 233, AMERICAN MACHINIST.

WISCONSIN.

Technical graduate, 10 years' experience drafting, shop and correspondence, past 3½ years charge design and assistant to superintendent moderate sized shop building special machinery, wants similar position. Box 227, AMERICAN MACHINIST.

Help Wanted.

Classification indicates present address of advertiser, nothing else.

CANADA.

Wanted—Seven first-class toolmakers; state experience, wages wanted and how soon you could report in Quebec. Ross Rifle Co., Quebec, Canada.

Wanted—First-class operator on Jones & Lamson flat turret lathe; one who can read drawing; state experience and wages wanted. Ross Rifle Co., Quebec, Canada.

Wanted—First-class engineer and draftsman; technical graduate preferred; one with experience in water-wheel, pulp and sawmill work; state age and experience. Box 205, AMERICAN MACHINIST.

CONNECTICUT.

Wanted—Two first-class toolmakers for a special line of small, accurate work; a man well trained on watch factory die work preferred. Veeder Mfg. Co., Hartford, Conn.

Wanted—Working foreman in a toolroom employing 6 or 8 hands, by a company in Hartford, Conn., manufacturing electric switches; must be thoroughly familiar with small punch and die work of good class; state fully previous experience, also salary expected. Box 209, AMERICAN MACHINIST.

ILLINOIS.

Wanted—A contracting engineer, familiar with coal-handling machinery and plants; headquarters in the Middle West; permanent employment for the right man. Address, giving age, experience, references and salary wanted, Box 215, AMERICAN MACHINIST.

Wanted—Superintendent to take charge of

the manufacture of gas engines on a large scale for a company just commencing the manufacture of gas engines; must be thoroughly familiar with the details of manufacturing gas engines in every respect; must have thorough, practical experience on gas engines; of good character; good organizer; must have tact and ability to handle men to the very best advantage; technical education not absolutely necessary; need not be a designer; best of references must be furnished; to the right man a good position. Box 194, AMERICAN MACHINIST.

MICHIGAN.

Wanted—A competent man, familiar with erecting cranes and crane runways. Box 207, AMERICAN MACHINIST.

Wanted—A recent graduate as assistant in a technical school mechanical engineering laboratory and drawing room. Box 153, A. M.

Wanted—Experienced draftsman; must be a good mechanic, a reliable man and have had experience designing jigs and fixtures for manufacturing first-class machine work on the interchangeable plan by the latest modern practise; state age, experience, wages and references; plant pleasantly located in Middle States. Address Box 179, AM. MACH.

NEW YORK.

Superintendent for machine shop. Address, stating references and salary expected, A. B. C., care AMERICAN MACHINIST.

Competent foreman for planer and milling department; state experience, age and salary. Niagara Machine & Tool Works, Buffalo, N. Y.

Two good draftsmen on work similar to light structural iron and wood work; must have had at least 2 years' drafting experience; state age, salary expected and references. Box 218, AMERICAN MACHINIST.

A superintendent and mechanical engineer wanted for old established, highly successful manufacturing company; investment required, but thoroughly protected; attractive salaries to right men. Box 231, AMER. MACHINIST.

Wanted—Expert mechanical engineer and designer; one who thoroughly understands designing jigs, tools, fixtures and special machinery; a good position open to an A1 man. Address A. R. Mfg. Co., care AMER. MACH.

Wanted—Hustling foreman for machine shop in large electrical factory in Canada, particularly on induction motors and direct-current work. Apply, giving references, experience and wages required. Box 189, A. M.

Wanted—A few first-class erectors on large vertical engines, a few A No. 1 boring mill and lathe hands for heavy work, also a competent man for laying-out table. Apply, with reference, to The Snow Steam Pump Works, Buffalo, N. Y.

Toolmakers on gages, tools and fixtures for the manufacture of high-class interchangeable work, similar to type-setting and typewriting machines; only first-class men wanted; state age, previous experience and wages expected. Address Box 216, AM. M.

Wanted—Foreman for toolmaking department of large manufacturing concern in Rhode Island; must have experience, executive ability and force; to take charge of 40 toolmakers and direct making from drawings, special tools, jigs, fixtures and models for small, high-grade machinery. Address, stating qualifications, Howard D. Black, P. O. Box 267, New York.

Wanted—A young married man, of good presence, to act in the East as special representative of leading firm of machine tool builders; experience in selling machine tools and acquaintance with the trade desirable, but not essential; preference will be given one who has had both practical and technical training and some business experience; must have highest references as to character and reliability; a splendid opportunity for the proper man; in writing, state age and give full information about work done. Address Box 192, AMERICAN MACHINIST.

PENNSYLVANIA

Wanted—A first-class draftsman. Address Box 217, AMERICAN MACHINIST.

Want an instructor in machine shop. Send application and references, stating shop experience, education, age and minimum salary that would be accepted, to Dean, School of Engineering, State College, Pa.

Wanted—First-class toolmakers and machinists; we have a model shop, new tools, no labor troubles, plenty of work, and are situated in a small town where living is cheap and where all advantages can be secured. Address The Greer-Clarkson Co., Manheim, Pa.

The Monotype Company maintains a school to train young men to meet the constantly increasing demand for operators of its type casting and composing machine. These operators have done so well that it receives more applications for places than can be filled. In making selections these qualifications carry most weight; common sense, type foundry experience, printing office experience, automatic machinery experience. Full particulars will be furnished to inquirers who furnish the same information about themselves. The Lanston Monotype Machine Co., 1231 Callowhill st., Philadelphia, Pa.

WEST OF MISSISSIPPI.

Wanted—A blacksmith as foreman and instructor in college blacksmith shop; prefer a young man with considerable experience in high-grade steel work. Box 234, AM. MACH.

Woodworker for cabinet, pattern and some rough work in repair shop of technical school; will be only one in shop; no teaching; state wages and experience. Address C. S. M. Golden, Colo.

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The St. Louis Exposition—XII.

EDITORIAL CORRESPONDENCE.

PRESENT TENDENCIES IN MACHINE TOOL DESIGN.

Summing up the impressions made by the machine-tool exhibits at St. Louis, two leading ones stand out—that the motor drive is an accepted fact and that the cone pulley, so far as the main drive of belt-driven tools is concerned, is passing into history. In a sense these two movements are interlocked. The adaptation of machine tools to the diverse requirements of different makes of motors, while at the same time retaining the belt drive for those who prefer it, has been a source of heavy expense to machine-tool builders and the gear-box drive with its constant speed belt has been seized upon with avidity as a happy expedient for overcoming the difficulties of the situation. That system reduces the motor to its simplest and cheapest form—the constant speed machine—and with the flexibility of the belted connection to the motor in giving the speed required, adapts the tool to almost any make of motor having the required power and at the same time retains the easy application of countershaft driving. Moreover, by surmounting the inherent objection to the cone pulley—the slowing down of the belt just when the most power is needed—that is, when doing large work—it scores a distinct advance in fundamental design. Our readers will recall that the first appearance of this system of driving was on the Bickford radial drill shown at the Pan-American Exhibition of 1901. Inasmuch as our forecast has already come true, we will be excused for quoting from our description of Mr. Norris' design as given at page 1177, Vol. 24:

"It is quite possible that this arrangement of the Bickford radial may turn out to be the first step in a widespread abandonment of cone pulleys. Not the least of its advantages is the fact that when driven electrically it adapts itself so readily to constant speed motors to the use of which many are returning after experience with those arranged for variable speed. The corresponding arrangement of feed gearing has obviously come to stay and there would appear to be quite as many advantages attending the use of the principle in the driving as in the feeding mechanism."

Alongside of this increasing use of the constant speed motor in combination with a gear box, another rival line of development is going on in the use of the very thing which the first was intended to avoid—the variable speed motor. This is no doubt due to the recent large increase in the speed ratio of these motors. At the time of the Pan-American Exhibition and, indeed, much more recently than that, the economical commercial limit of this ratio was set at about two to one. To-day we find motors on the market having a ratio of four and even five to one. With the former ratio several sets of gears were necessary to supplement the motor, but with present ratios these are reduced to a minimum. The net result is that for motor driving we see two rival systems in process of development—the constant speed motor with numerous combinations of gears arranged gear-box fashion for varying the speed and the variable speed motor with two or three arrangements of back gears. The former, by retaining the ease of connection to a countershaft, seems certain to maintain itself if countershaft driving is to continue, but should countershaft driving ever disappear the situation is less clear. So far as accomplishing its purpose is concerned, each system does this with entire satisfaction and the final choice will doubtless turn on questions of

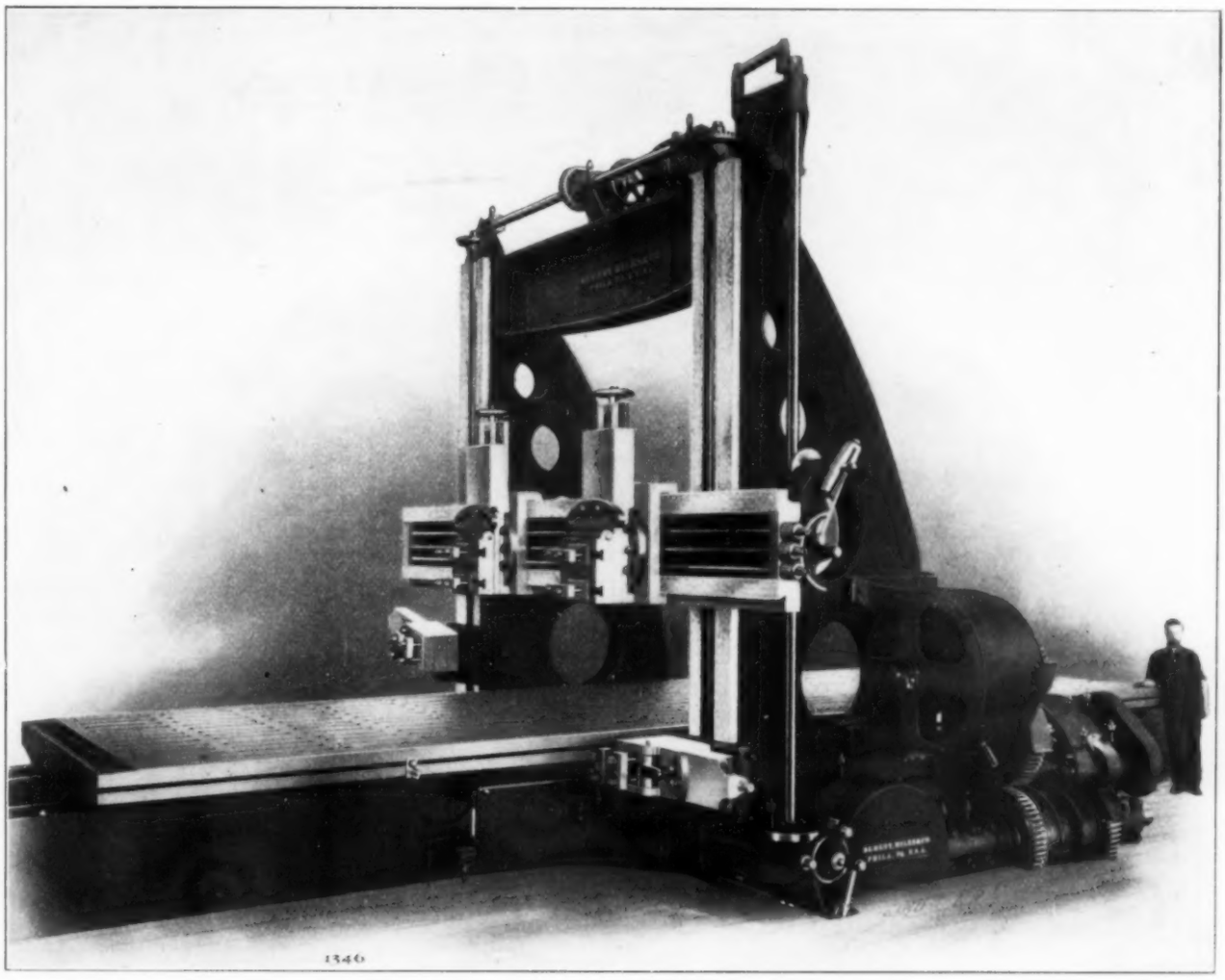


FIG. 1. 10-FOOT VARIABLE SPEED PNEUMATIC CLUTCH PLANER.

cost and durability. It is safe to say that for the smaller tools, at any rate, the retirement of the countershaft is yet far in the future and the case is hence likely to be decided on the larger tools, altho the matter is further complicated by the fact that, relatively speaking, the cost of motor equipment is less serious as applied to large than to small tools. In this connection it should be remarked that at St. Louis we see the beginning of machine tools designed exclusively for motor driving.

Another remark made in the report of the exhibits at Buffalo will bear repeating here: "Perhaps the most striking feature of the present line of development is the ever-growing elaboration of machine tools." One does not have to go back very far to recall the time when the complexity of present-day tools would have caused them to be scoffed at.

While the above impress one as the chief lines of development which are illustrated at St. Louis, it is impossible not to note also the widespread use of high-speed chains both for the main drive and for subsidiary use. I cannot get over my admiration for the action of these chains. When we consider the manner in which a chain drive was looked upon a few years back—a manner which was fully justified by the action of chains then in use—and contrast it with the silent perfect action of the chains of to-day, we must conclude that the chain makers have accomplished a remarkable feat.

THE NILES-BEMENT-POND EXHIBIT.

It is putting it feebly to say that not only no such exhibit as this has ever been made by a single exhibitor, but that by no other exhibitor in the world is such an exhibit possible. Of the machines shown we shall, however, show but comparatively few of the more noteworthy. Of these we select as the first the

Ten-Foot Planer.

This is one of the machines referred to above as designed especially for motor driving, and is shown in Fig. 1. It is, moreover, an illustration of the manner in which designers are beginning to turn to the motor as the simplest way of accomplishing many things; for here, instead of one source of power with mechanical means of distributing it to the places wanted, we see four motors, each placed to do one thing only. Of these the first is the main driving motor, of 50 horsepower, seen in the foreground of the illustration. The second is mounted on the housing girder, its office being to elevate the crossrail. The third, not seen in the illustration, is mounted on the rear side of the far end of the crossrail, its office being to traverse the heads upon the rail and to raise and lower the tool-posts; while the fourth—also out of sight in the illustration—is placed at the rear side of the bed-plate and operates the side heads. The reversal of the table is by pneumatic clutches, which are seen on the driving shaft below and beyond the main motor. The action of the table dogs is to trip the air valve attached to the bed in front of the housing, to which a lever is also attached for hand manipulation. In front of the man in the background will be seen a gear case which covers a set of change gears by which the speed of the cutting stroke may be varied between 18 and 36 feet per minute. The changing of these gears acts upon the cutting stroke only, the return speed being constant at 80 feet per minute. There is also a range of speeds available by varying the speed of the motor, this change acting of course on both cutting and return speeds.

Another tool of magnificent proportions is the

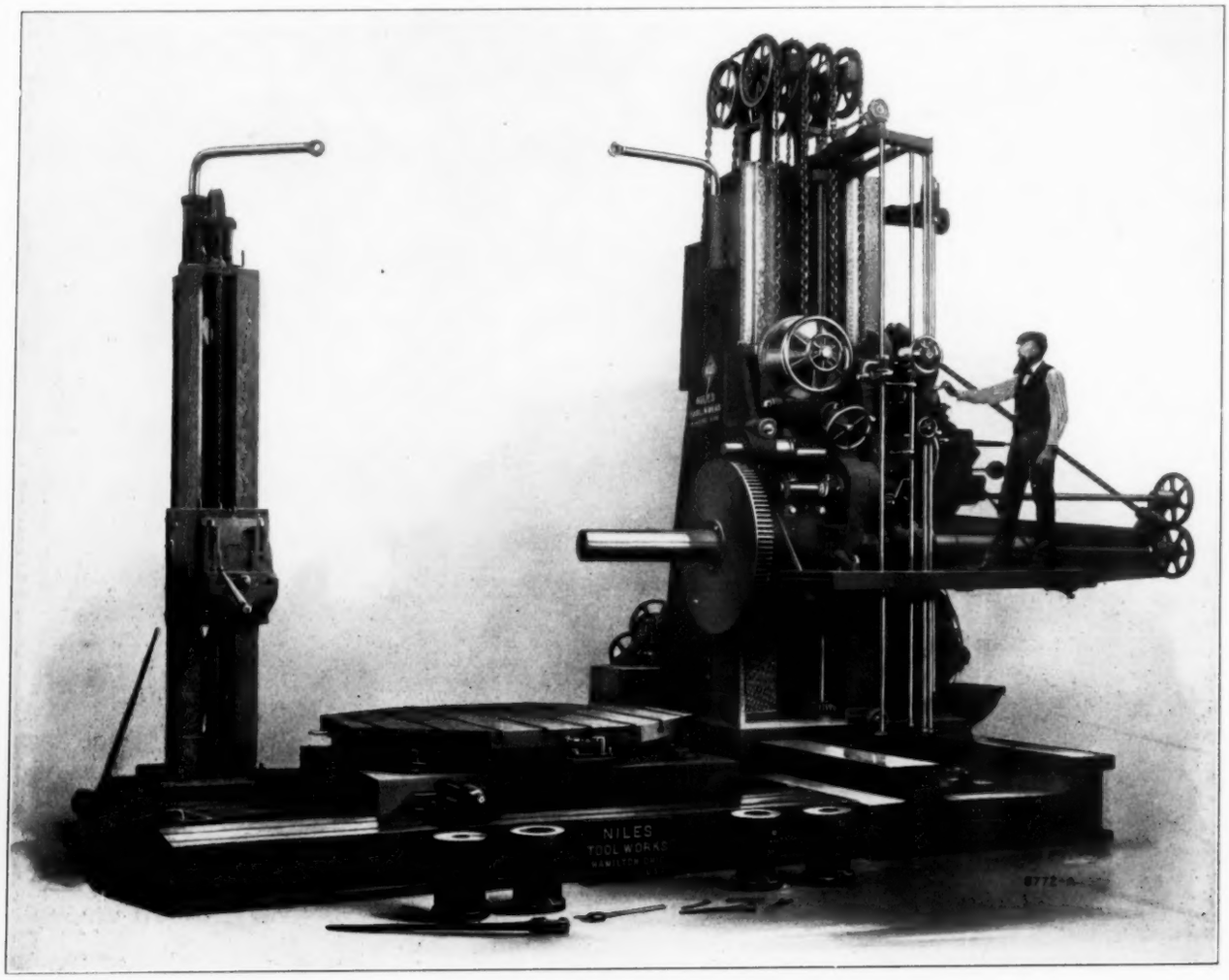


FIG. 2. HORIZONTAL BORING, DRILLING AND MILLING MACHINE.

Horizontal Boring, Drilling and Milling Machine,

shown in Fig. 2, and which also is fitted for motor driving, two motors being employed, of which one is the variable-speed main driving motor, which drives the spindle and all feeds except that of the work table, for which a special motor is provided, giving a feed to and from the spindle as well as a circular feed. The revolving table is fitted with a dial indicator for use in squaring work by milling heads or in drilling holes at right angles with one another. This indicator rests in a circular case shown in front of the revolving table, four arms in quadrature with adjustable screws for contacting with the indicator being placed upon the four sides of the table, of which two are in view in the illustration. These screws are not adjusted by the maker, for obvious reasons, the intention being that the user shall do his first piece of work by usual methods and take advantage of the opportunity to adjust the screws once for all. The case for the indicator is mounted upon a stud, in order that it may be swung out of the way of the stop-screws when the table is revolved, and it is also removable to get it out of harm's way when not in use.

The magnitude of the machine is shown at a glance by the man standing on the operating platform, but it may be said that the spindle has a traverse of 72 inches, while the saddle has a vertical movement of 8 feet and the column a horizontal movement of 12 feet. All spindle, saddle and column movements are controlled from the operator's platform. Fixed scales are provided on bed, columns and saddle for setting the outboard bearing in alinement with the spindle.

The driving motor has a capacity of 30 horse-power, is intended for the multiple-voltage system and has a speed ratio of 4 to 1.

Another tool that is noteworthy because of its size is the

Twenty-Foot Boring Mill.

As it stands at St. Louis, this machine has a boring bar with traveling head in position, tho this is not shown in the illustration, Fig. 3. A supplementary motor is provided on the housing girder, which elevates the crossrail and gives the quick traverse to the tool-heads and tool-bars. The ordinary feeds for these parts are operated from below, the levers for engaging the feed and traverse gears being interlocked in such manner that it is impossible for both gears to be thrown in at the same time. Mounted between the housings is a supplementary tool-post, which is adjustable radially to have a range suitable for turning flywheels, etc.,

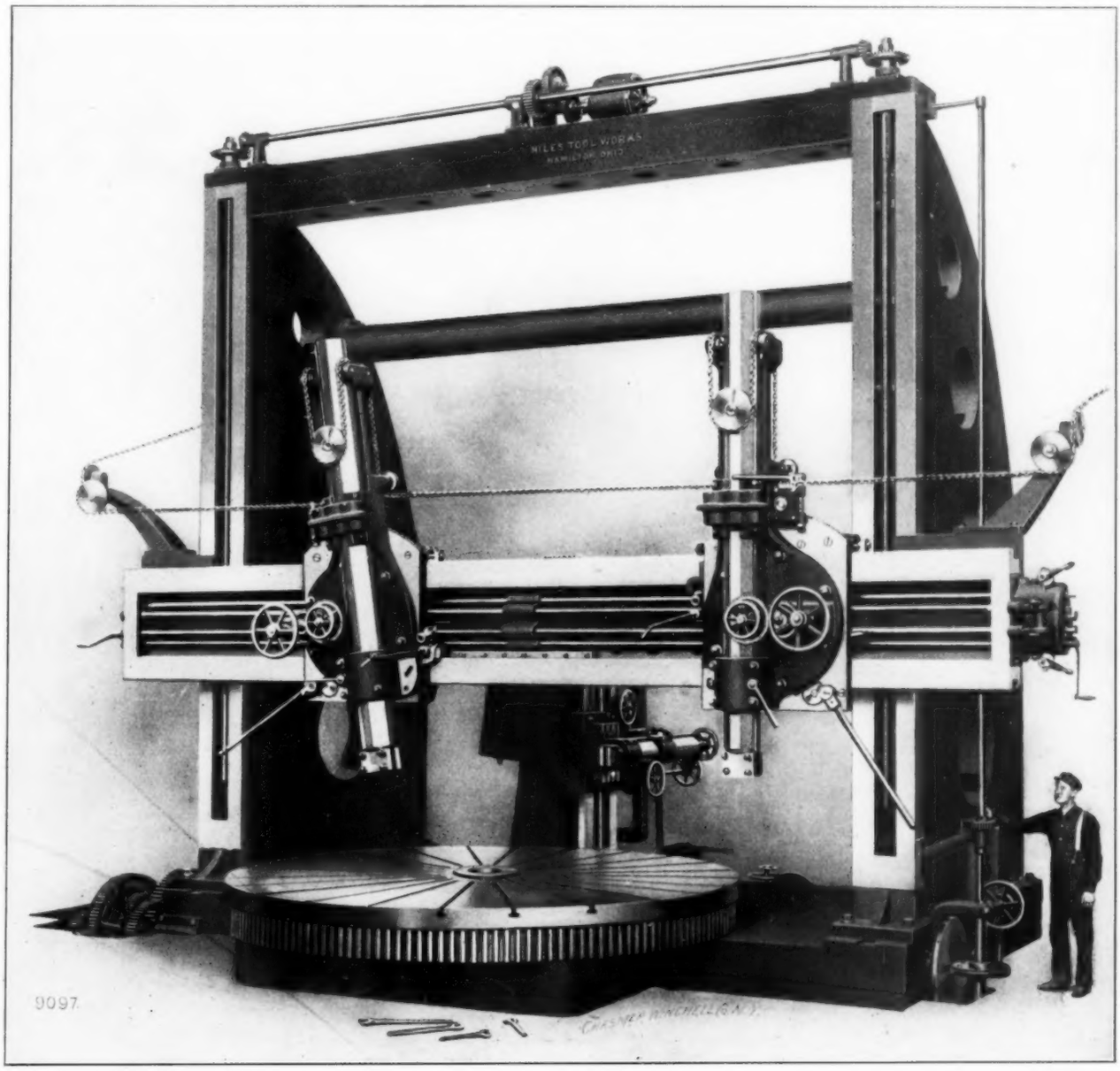


FIG. 3. 20-FOOT BORING MILL.

from 14 to 20 feet in diameter without overhang of the tool, and an auxiliary bar is provided for smaller diameters. The post has a taper attachment for turning crowned pulleys, and in the ordinary use of the mill on such pulleys the post is used for turning the lower half of the face, while one of the crossrail saddles is used for the upper half. The main driving motor has a capacity of 80 horsepower. It is a variable-speed machine, with a speed ratio of 4 to 1.

Fig. 4 shows a

New Model Motor Driven Pond Lathe

of 28 inches swing, which is one of the most interesting machine tools in the entire exhibition. It is a typical representative of the second line of development mentioned above in which a variable speed motor is combined with trains of gearing the one being designed for the other, and the result being a combination and not a mere aggregation. The control of the entire machine is from the carriage, the crank on the vetrtical shaft at the right of which is connected with the controller and gives fifteen speeds, the motor having a speed ratio of 2 to 1. The crank near the lower end of this shaft turns the upper of the two splined rods and thru the gearing at the left drives the sleeve which is supported by the lead screw and which carries two cams which actuate two levers which hang down in front of the headstock. Each cam gives three positions to its lever—right, left and central. At the right and left positions the levers throw in friction clutches connected with the driving train while at the mid-position the clutches are disengaged. The turning of this cam sleeve therefore engages four sets of gears in succession, thus multiplying the fifteen motor speeds by four. The ratio of gearing is such that one complete turn of the apron crank is necessary for each change and a moving indicator dial shows at all times which train of gears is engaged. The splined shaft which, by turning, is made to actuate the cam sleeve, is also made, by sliding endways, to act as a stop rod, adjustable collars being attached to it for this purpose, as also a special handle at the right of the carriage the purpose of which is to enable the feed to be stopped instantly by hand when necessary.

The feed motion is equally interesting, giving, as it does, thirty-two rates of feed, and by disengaging the feed gear and engaging the split nut upon the lead screw, thirty-two threads ranging from one to sixteen per inch, all with a single lever which needs only to have its stop pin dropped into the proper hole to give the feed or thread required.

To accomplish this the lever, which usually carries a simple idler gear which it drops into mesh with the cone gears, carries in this machine a frame in which are four sets of gears, each of which when dropped into a given place in the cone gives its own rate of feed. To avoid undue length two of these are arranged above

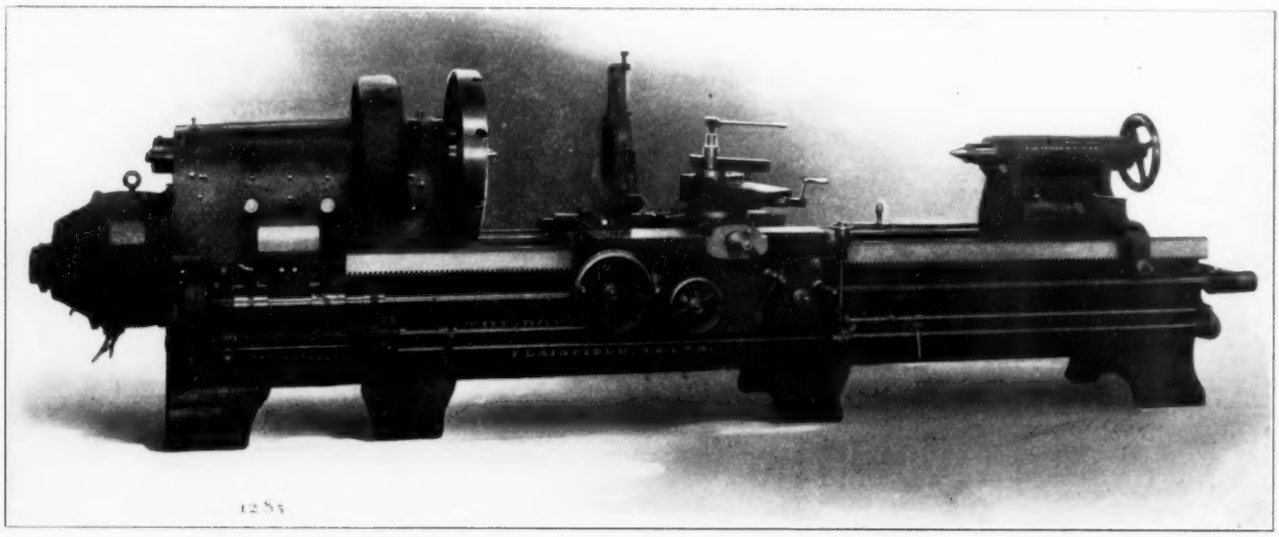


FIG. 4. 20-INCH NEW MODEL LATHE.

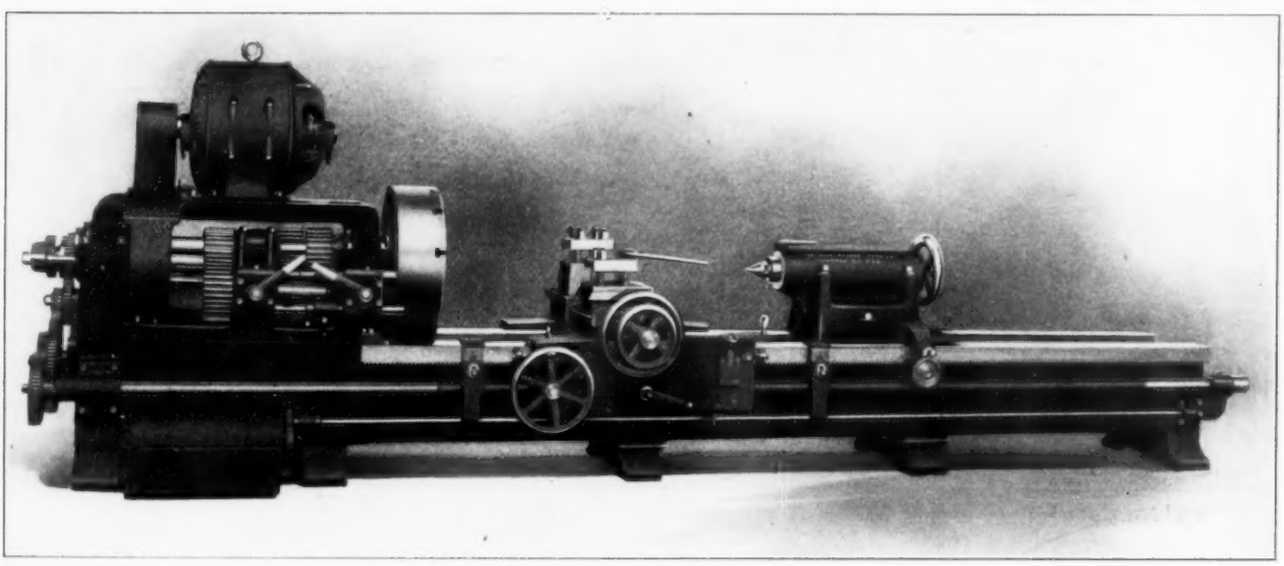


FIG. 5. 30-INCH RAPID REDUCTION LATHE.

the center line and two below, and the pin holes are arranged in two rows, as clearly shown in the illustration. Between the rows of holes is a substantial groove into which the end of the latch pin may be dropped and which thus forms a guide for the pin when the lever is being adjusted. The holes are numbered as shown, and an index plate shows at once the feed for each hole. In addition to the holes and guide groove a notched plate within the bed makes it necessary to pull the gears out of mesh before the sliding lever can be moved and to locate the gears correctly before they can be again engaged.

Fig. 5 shows a

Thirty-Inch Rapid Reduction Lathe

which in its system of driving is an interesting contrast to the machine just described. The motor, of 25 horse-power, has a speed ratio of 4 to 1 instead of 2 to 1, and there are but two gear combinations instead of four, one of which drives thru the spindle while the other drives by the face-plate gear. The gears are manipulated by the two handles in front of the headstock, which are so interlocked that it is impossible to engage both combinations. Thirty speeds are provided which, except for the changing of the gear combination, are controlled from the carriage.

Another striking machine is the

Eighty-Inch Driving Wheel Lathe

shown in Fig. 6. Perhaps the best indications of the character of work for which this lathe is intended are the provision for securing the movable headstock in position in the bed (for both stocks are driven and hence both are headstocks) and the capacity of the main motor, which is of 50 horse-power. In this lathe we see another instance of the provision of a special motor for manipulating the machine, the traversing of the carriages and of the movable headstock being done by a small motor at the right of the machine and not shown in the illustration.

Both headstocks have adjustable centers in order to reduce overhang to the lowest possible amount and for the same reason, as well as to provide additional driving power to the work, the face-plates are provided with openings for the crank pins. Steel wedges with screw adjustments are fitted to these openings for positively engaging both pins—this drive being additional to that thru the usual drivers attached to the face-plates and engaging the arms of the wheels. F. A. H.

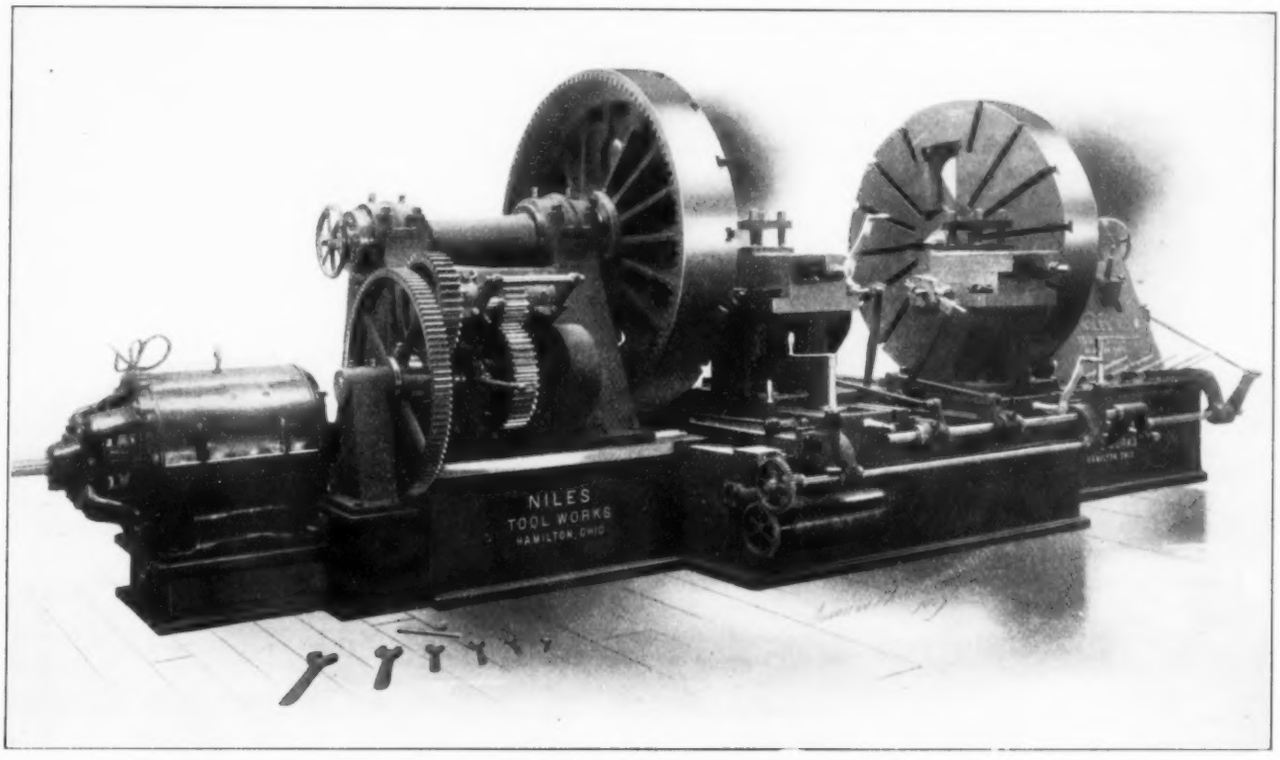


FIG. 6. 80-INCH DRIVING WHEEL LATHE.

A trade journal contemporary, in whose columns we have never happened to see the least condemnation of the practise of lobbying or of influencing legislation in favor of certain "interests" by means of judiciously distributed cash, has discovered that when American citizens, or an association of such citizens, ask a man who, as a candidate for Congress, is looking for their votes, what, if elected, he will do in regard to certain legislation in which such citizens are interested, they are "coercing" him. In other words, an American citizen who, mistakenly or otherwise, believes a certain law ought to be passed has no right to ask a candidate whether or not he will support such law if elected, but should vote for him first and ask him afterward!

Thinking Unprofitable Without Continual Investigation and Experiment.

The following is from the commencement address by Ira Remsen at Worcester Polytechnic Institute, June 9, 1904:

A child learns a great deal in regard to his surroundings in his earliest years before he goes to school and without the aid of his parents. He is constantly engaged in making observations and drawing conclusions, and his actions are largely guided by the knowledge thus gained. After a time school life begins, and the child then begins to study books and to acquire knowledge at second hand. This is an entirely different process from that by which he gained his first knowledge. The latter is natural; the former is artificial. Then, too, he soon discovers that many things he sees call for explanation, and he is led to wonder what the explanation is. If he has a strong imagination, as most children have, he will probably think out some explanation. He finds that he can use his mind, and that this helps him in dealing with the facts in nature. Now comes the danger. It being much easier to think than to work, the chances are that in trying to find the explanation of things, he will give up the natural method and be satisfied with the products of his imagination. He will gradually give up dealing directly with things and take to thinking alone. When this stage is reached his knowledge will increase very slowly, if at all.

Whether this picture of the development of a child is in accordance with the facts of life or not, it gives an idea of the mental development of mankind. First came

the period of infancy, during which observations were made and much was learned. Efforts were early made to explain the facts of nature. We have remnants of these explanations in old theories that have long ceased to be useful. They no doubt served a useful purpose in their day; but gradually one of the most pernicious ideas ever held by man took shape, and I am willing to characterize it as one of the most serious obstacles to the advance of knowledge. I refer to the idea that it is a sign of inferiority to work with the hands. This idea came early and stayed late. In fact, there are still on the earth a few who hold it. How did this prove an obstacle to the advance of knowledge? By preventing those who were best equipped from advancing knowledge. The learned men of the earth for a long period were thinkers—philosophers. They were not workers in nature's workshop. They tried to solve the great problems of nature by thinking about them. They did not experiment. That is to say, they did not go directly to nature and put questions to her. They speculated. They elaborated theories. During this period knowledge was not advanced rapidly. It could not be. For the only way along which advances could be made was closed. Slowly the lesson was learned that the only way by which we can gain knowledge of nature's secrets is by taking her into our confidence. Instead of contemplation in a study, we must have contact with the things of nature either out of doors or in the laboratory. Manual labor is necessary. Without it we may as well give up hope of acquiring knowledge of the truth. When this important fact was foced upon the attention of men, scientific progress began.

There is something just a little queer—and not altogether amusing—in the fact that the latest advance in the price of coal comes just as the mine-owners suspend operations for a week because their stocks on hand have become inconveniently large and they want to give consumption a chance to catch up with the supply. Overproduction usually results in a lowering, not a raising, of prices, but the coal trade is peculiar in many ways, and it has as good a right to be peculiar in this matter of prices as in other matters. And even a consumer can see that a stoppage of production is a much pleasanter device—from the standpoint of a mine-owner—than a dropping of prices would be. Buyers are to be taught to lay in their winter supply of coal in the spring, instead of in the summer or the fall, as they did formerly. They are reluctant to do it, for it locks up a considerable sum of money which some of them would like to have the use of for a few months, but the coal companies find the new scheme an admirable one, and nothing else is necessary.—*New York Times.*

Calculating Cone Steps and Back Gearing Ratios by the Slide Rule.

BY ROBERT A. BRUCE.

All designers who have had to deal with the problems of determining the sizes of cones, ratios of gearing and speeds of countershafts for machine tools, will have appreciated the systematic method advocated by P. V. Vernon in a paper read before the Manchester Association of Engineers, and reprinted in the AMERICAN MACHINIST at page 1790, Vol. 26. It is hoped that the method here described may still further reduce the labor involved in such problems.

As clearly stated in the paper alluded to, the first thing necessary is, given the fastest, slowest and total number of speeds, to determine the intermediate ones. This can be done in an extremely easy and expeditious manner by using the scale of an ordinary slide rule in conjunction with drawing instruments. The method is best explained by taking an actual case, viz., that given in example 1 of Mr. Vernon's paper: Fastest speed, 280; slowest speed, 20; number of speeds, 12.

Lay off a straight line such that the length *A B*, Fig. 1, is equal to the distance between the points 20 and 280 on the *B* scale of the slide rule (on the ordinary rule this would measure about 143.6 millimeters) and divide it into eleven equal parts—*i. e.*, one less than the total number of speeds. The extreme and intermediate dividing marks will then form twelve graduations at equal intervals, and on applying the scale so that 20 comes opposite the first and 280 opposite the last, as in Fig. 1, the numbers found opposite the remaining ten divisions will be the intermediate speeds required. The accuracy thus attained is sufficiently close for the purpose in view. This method is obviously available for any problem requiring the insertion of a number of geometric means between two numbers. A record of the speeds thus obtained may be made by writing opposite each graduation of the divided line the corresponding scale reading of the slide rule.

The percentage drop in changing from any speed to the one below may be at once obtained by inspection. For, applying the scales so that 100 of the slide-rule scale is opposite one graduation of the paper scale, it will be seen that the next graduation on the right falls opposite 127 on the scale, while the nearest graduation on the left lies against 78.5. The interpretation of these figures is that the percentage drop of speed is 100 — 78.5, or 21½ per cent., and the percentage rise of speed is 127 — 100, or 27 per cent.

The scheme to be now adopted for securing the ideal speeds recorded must be settled by the peculiar circumstances of the case, rather than by hard and fast rules. We will therefore assume two different cases, omitting what is perhaps the simplest plan of all, viz.: the method quoted by Mr. Vernon, of a two-speed countershaft and cone of three steps with back gear. Let us first of all assume a single-speed countershaft and a cone with six steps and back gearing, the six quickest speeds being delivered direct by coupling the cone to the spindle, and the slower speeds being secured by the use of back gearing. Let us also suppose that by the conditions of the problem the diameter of the largest cone step is fixed at 20 inches. The speed of the countershaft is equal (whether the number of cone steps is odd or even) to the geometric mean of the fastest and slowest driven cone speeds. If we therefore bisect that portion of *A B* lying between 7 and *B*, we obtain a line marked "Countershaft for six-step cone drive," which at once gives the scale reading 153 for the countershaft speed. Again the ratio of back gear is given by shifting the slide so that the point *A* comes opposite the point 1 on the scale, as in Fig. 2, when we shall have 4.25 as the scale reading opposite 7, this giving the ratio of the back gear.

The sizes of the cones now require fixing, and if lines *C*, *D*, *E*, midway between the main divisions 1 and 2, 2 and 3, 3 and 4, Fig. 2, are drawn with the slide in the position shown, we get scale readings of the ratios of the cones.

The result follows from the fact that if the counter-cones and driven cones are similar the ratio of the diameter of steps equidistant from the middle is the square root of the ratio of their respective speeds. Thus in a three-speed cone where the diameter of the largest cone is twice the diameter of the smallest, the fastest speed is four times the slowest.

Thus *C* gives 1.13 for the ratio $\frac{\text{dia. cone 3}}{\text{dia. cone 4}}$

D gives 1.43 for the ratio $\frac{\text{dia. cone 2}}{\text{dia. cone 5}}$

E gives 1.82 for the ratio $\frac{\text{dia. cone 6}}{\text{dia. cone 1.}}$

Now cone 6 being fixed on as 20 inches in diameter, cone 1 is found by direct proportion to be as nearly as possible 11 inches. In practise the diameters of the intermediate cones would usually be taken in arithmetical progression, the results so obtained being sufficiently near the values sought. But if closer results are required, remembering that the sum of the diameters of a pair of cone steps is constant and equal to 31 inches (20″ +11″) if r is the ratio of any pair the diameter of one of them is $\frac{31\,r}{r+1}$ and that of the other $\frac{31}{r+1}$. The lines *C*, *D*, *E*, of Fig. 2, may be entirely dispensed with in the case where the cones have equal steps. The diameter of the largest cone being settled by practical conditions, that of the smallest can be found direct as illustrated in Fig. 3. Opposite 6 in the line *A B* place 20 (the diameter of the largest cone) of the *C* scale of the slide rule, and opposite the first graduation of

$A\,B$ find 10.97, or say 11 inches on the C scale.

It will be seen therefore that the above operations have involved: (a) the measurement of the distance between two points of the B scale, (b) the transfer of this distance to the paper, (c) its division into eleven parts, and (d) the further bisection of one of these parts by a line. The results obtained by direct reading are: the appropriate speeds, the countershaft speed, the gearing ratio and the sizes of the cones, all of which are obtained without calculation. The method to be adopted for finding suitable gears to give the required ratio will be explained later.

The second variation is to employ a four-speed cone delivering its motion either direct or thru two changes of gearing. The first step would be exactly the same as before, the distance $A\,B$ being the scale distance between fastest and slowest speeds on the B scale, and the intermediate speeds being read direct as before. The scheme of operations is shown in Fig. 4. The countershaft speed is obtained at the same time as the intermediate speeds by taking the scale reading of a line bisecting the fastest and slowest cone speed lines. The gear ratios are obtained on the B scale, from P to Q and from R to S, the unit of the slide-rule scale being placed respectively at P and R. The size of the smallest cone is given by the reading $M\,N$ on the C scale, 20 (*i. e.*, diameter of the largest cone step) being placed at N and the diameter of smallest cone being given on the C scale at M as 14 inches.

Thus far gearing ratios have been obtained, but no explanation has been given of the best method of finding the teeth in the wheels so as to give the appropriate ratio. The clue to all such problems is the easily remembered fact that in a pair of wheels whose ratio is r the number of teeth in the pinion is

$$\left(\frac{\text{sum of number of teeth}}{r+1}\right)$$

Now, the sum of the number of teeth is always fixed when the centers of the wheels and the pitch have been determined. In compound gears the simplest case is back gearing where both pairs are equal. The total ratio of the gearing has been determined in the foregoing cases by a simple reading on the B scale, see Fig. 2, where the total ratio is 4.25. Using the C scale, however, we should obtain the square root of this ratio and should thus have the ratio of each pair of wheels. Thus if 1 on the C scale is put opposite A in Fig. 3 the line 7 would come opposite 2.06. And if the total number of teeth in each pair were 150, we should have as the number of teeth in pinion $\frac{150}{2.06+1}$ or 49 nearly, and of the wheel, $150 - 49 = 101$.

Returning to the case in Fig. 4, a convenient method of obtaining the changes of gear would be as in Fig. 5, where only three sizes of wheels are used, all of the same pitch but of decreasing breadths as we move from right to left. The fast or first gear is thru the equal wheels $A\,A$ and $C\,B$, the total ratio being 2.61. If the number of teeth as before is 150, then the number of teeth in C is obviously $\frac{150}{3.61}$ or 43, and for B we have number of teeth $= 150 - 43 = 107$, while A has 75 teeth. The simplicity of the processes explained is obvious and the method can be modified by anyone understanding the principles of the logarithmic scale.

Leeds, England.

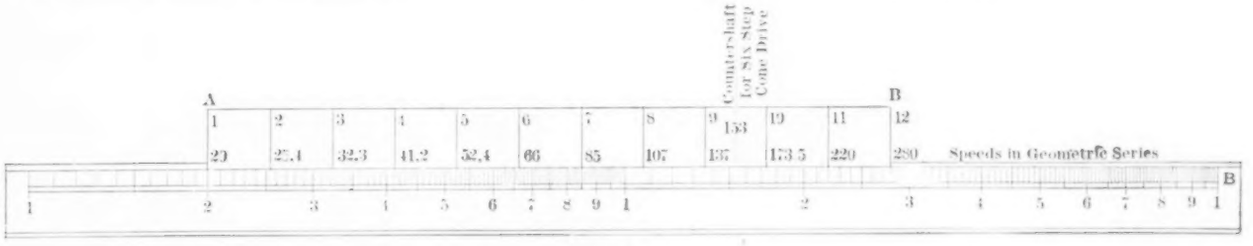


FIG. 1

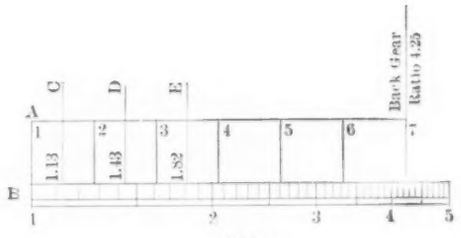


FIG. 2

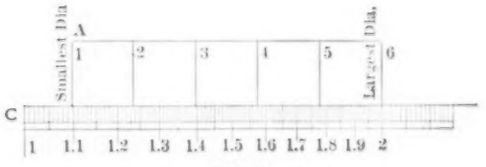


FIG. 3

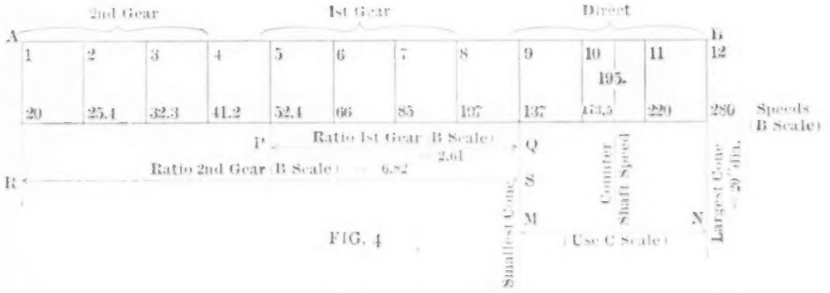


FIG. 4

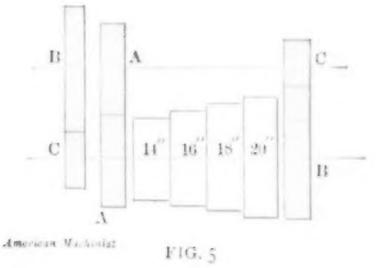


FIG. 5

LAYING OUT CONE PULLEYS AND BACK GEARS BY THE SLIDE RULE.

Radium seems to be coming into use even more rapidly than aluminum did, and its wonders are getting into the papers. *Something Pneumatic* publishes a half-tone showing an air motor "mounted on a *radium* arm." What is really shown is an air-motor-driven drill mounted upon the radial arm of an "old man" of the familiar type.

In the flying kilometer race at Ostend, Belgium, on Wednesday, July 20, Rigolly, of Paris, in a 120 horse-power Gobron-Brillie car made a new record of 21⅗ seconds, corresponding to a mile in 34⅘ seconds and 103.57 miles per hour.—*The Horseless Age.*

Machine Molding—II *

BY G. P. CAMPBELL.

RING, LINK AND LIGHT WORK.

Fig. 1 shows the flask described in the preceding article. Figs. 2 and 3 show the construction of boards and pattern plates. They are made of strips of hardwood 1½ inches wide, either mahogany, cherry or walnut, the first preferred. Pine may be used but will not give as good results. A board is jointed and then dressed to 1½ inches on the planer, cut to the length, or ½ inch longer; strips are cut off 1¼ inches thick and then these strips are glued together. Each alternate piece is well warmed before gluing. The glue is put only on each intervening cold piece, and thick glue should be used. Temporary cleats are clamped on the back and all is clamped well together to get good joints. When the glue is hard the cleats are knocked off, the surplus glue is scraped off, a light cut is taken on the jointer on both sides and each side is then cut on the circular saw for strips *X X*, as shown. These strips, which cross the grain, are warmed, glued and clamped. When the glue is thoroughly hard a light cut is taken on the jointer on each side and they are then run through the planer to a standard thickness of 1 inch; no nails or screws are used. No hand planing is needed if the jointer and planer are in good order. Sandpaper is used and a coat of shellac is applied at once.

The pattern for the ring which appears in section in Fig. 4 is now located centrally on the stripping board, the outline of the pattern is scribed on the board and this is cut out, the hole being beveled 30 degrees, as shown in Fig. 2. The hole should be a nice fit around the pattern, so that it will strip all right. The pattern is now correctly located and fastened on the pattern board, Fig. 3.

If kept in a good, dry pattern storage these boards and patterns should last for years. No rapping is needed, and there is no wear to speak of on the patterns, and no work is required except to keep them varnished. For small work as many as thirty or forty pieces can sometimes be put on one board, and where the pattern strips little or no draft is required.

A jig for the four pin-holes, which are same as those of the flask, Fig. 1, is laid on both boards on the boring machine and the holes are bored thru both at once and the two pins, as shown at Fig. 6, are now screwed on the bottom of the pattern board at opposite corners. This completes the nowel. Fig. 4 shows the pattern on the pattern board with the stripping board next and the flask on the stripping board all ready for ramming up. The two pins on the pattern plate extend thru far enough to go into the lugs of the flask, as shown at *A*, Fig. 4. The two pins in the flask are just long enough to come thru the stripping board. Fig. 6 shows the mold after the pattern is withdrawn, the stripping board still on the flask. Fig. 7 shows gate, runners and dirt gate as used in the cope. Fig. 8 shows mold ready for pouring. These rings after being cast are merely ground and highly polished so that all dirt

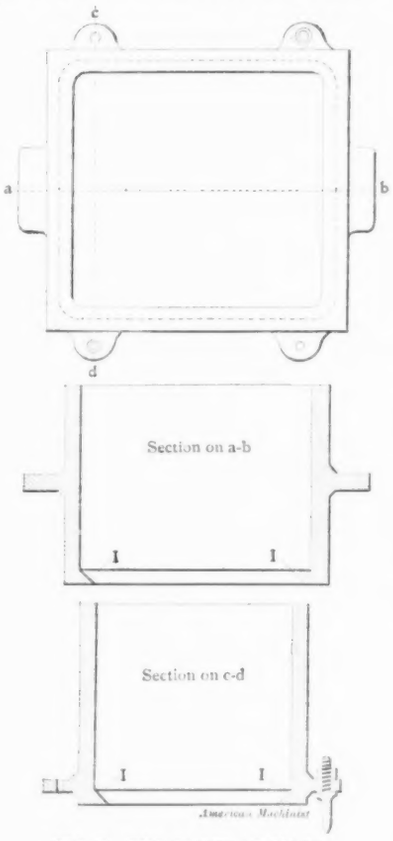


FIG. 1. THE FLASK AS MADE.

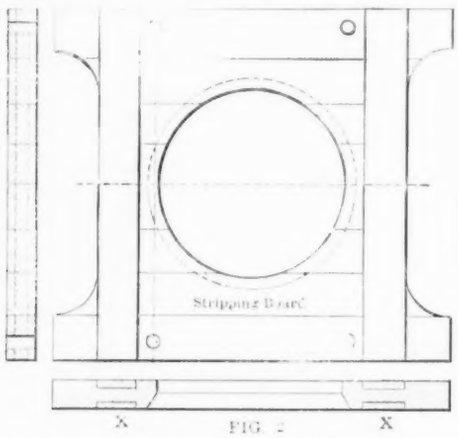


FIG. 2

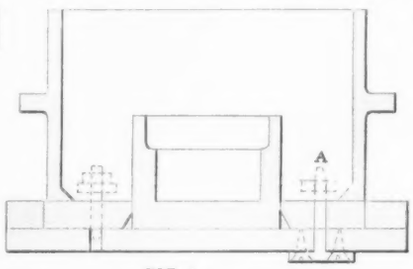


FIG. 4

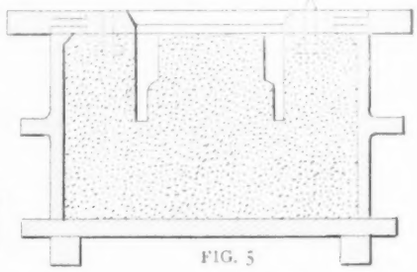


FIG. 5

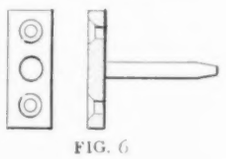


FIG. 6

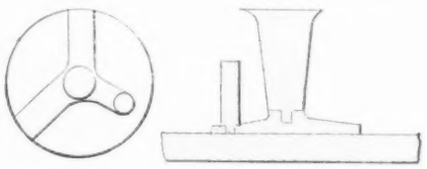


FIG. 7

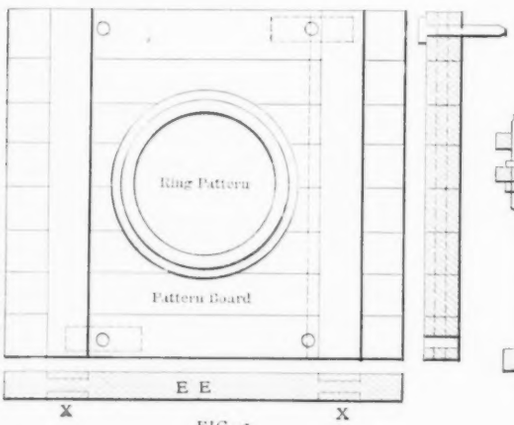


FIG. 3

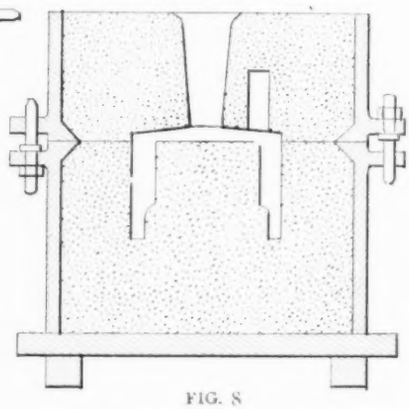


FIG. 8

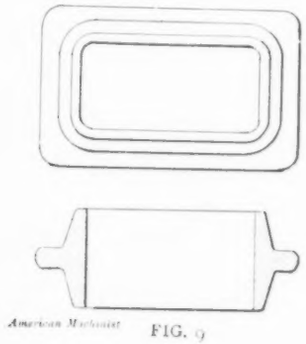


FIG. 9

MACHINE MOLDING.

* Copyright, 1904.

and sand holes must be avoided. The object of the dirt gate is to carry the loose sand and dirt in the mold as it floats on top of the iron to a point higher than the casting and confine it to that one place, and it does its work to perfection.

Fig. 9 shows a rectangular shaped ring or frame. It was necessary to cast this ring to size, allowing nothing for finish on it anywhere. Fig. 10 shows the nowel pattern board or plate. Fig. 11 is the stripping plate or board for both cope and nowel. Fig. 11 shows the cope pattern, the board, the gates on the pattern and the dirt gate; the gate pin is not shown. Fig. 13 shows the mold ready for pouring. The long pins prevent cope from striking the nowel in closing the mold.

At Fig. 14 is shown a steel casting of a link which also was required to be cast to size, a rather difficult casting to produce in steel. The pattern and pattern plate are shown in section. Fig. 15 is a plan of the pattern plate with three links (half patterns) with gates and runners attached. These being the same at each side tie all together and make the shrinkage equal. The dirt gate *X* takes a large percentage of the surplus collection of sand. Fig. 16 shows the mold ready for pouring. This flask is the same width as before shown, but is longer.

Fig. 17 is a section of a small circular cover piece cast in brass 3-32 inch thick over all, no finish. Fig. 18 is the pattern plate or board, the section showing pattern plate, pattern, stripping plate and gate pin in position. Fig. 19 is plan and section of the other half, and Fig. 20 shows the mold ready for pouring. The construction of all the boards shown is practically the same.

These little flasks can be piled up, one set upon the other, on a bottom board of course, six or seven feet high. As soon as the pouring time comes, one man takes them down as fast as they can be filled. I have in mind a small brass foundry located in a big establishment where it seemed there was no room to enlarge, yet with the system of flasks and patterns as described, and piling up the flasks when molded, more work is often turned out than in some shops with five times its room.

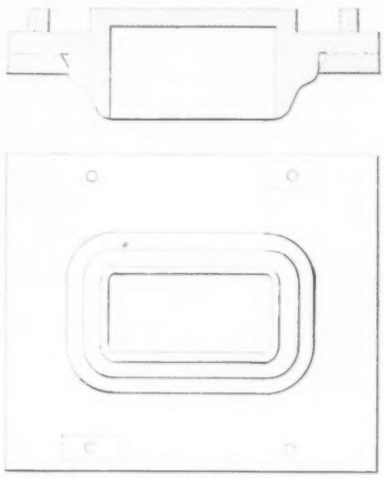


FIG. 10

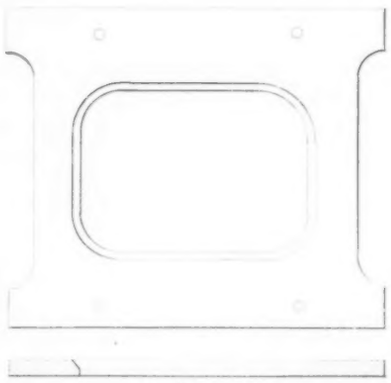


FIG. 11

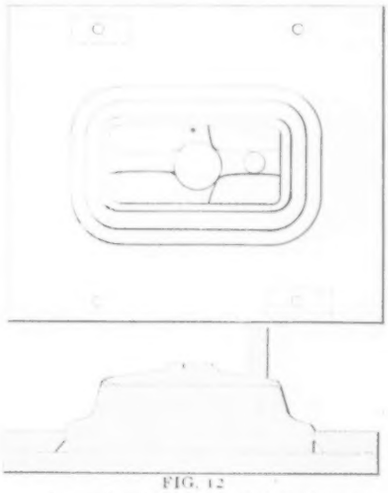


FIG. 12

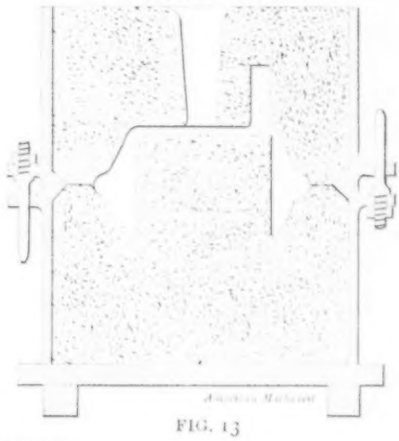


FIG. 13

MACHINE MOLDING.

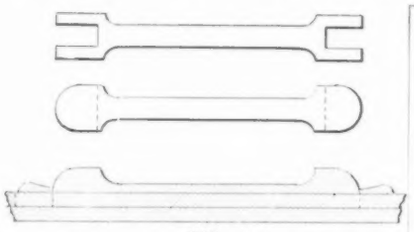


FIG. 14

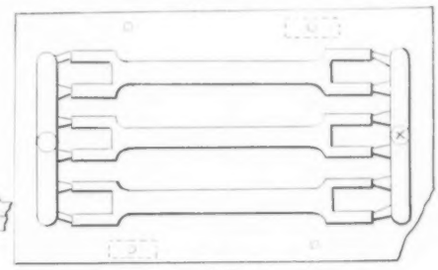


FIG. 15

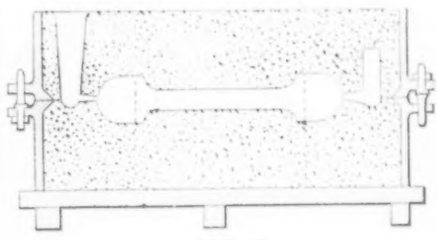


FIG. 16

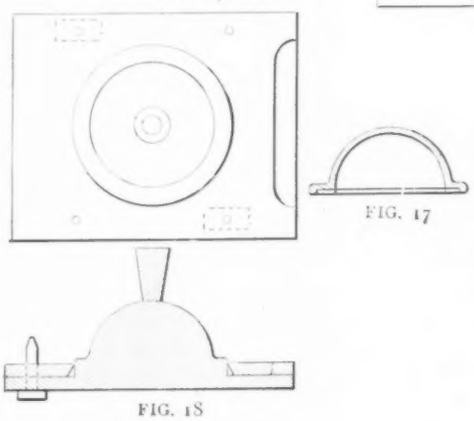


FIG. 17

FIG. 18

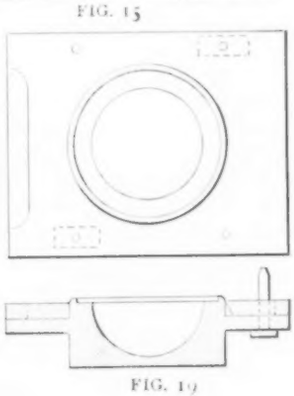


FIG. 19

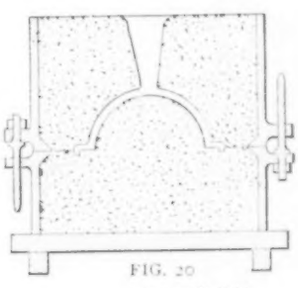


FIG. 20

MACHINE MOLDING.

Industrial Education in Germany—I.*

BY UNITED STATES DEPUTY CONSUL MEYER, CHEMNITZ, GERMANY.

The German industrial schools, however much they may have been derided and ridiculed by narrow-minded opposition in the primary stages of their development, have proven their worth. They are open, as a rule, not to a class or to a country, but to the world. In their halls rich and poor meet on equal terms as learners. They require comparatively little money, but educate thousands of hands and heads. They throb with the life about them, and grow with the world without. They are the most powerful weapons of German industry. They are the ironclads of commerce.

In the present discussion an attempt is made to show where and how in the German world of industry school and life touch each other; how this intimate relationship of education and industry was created and how it is maintained.

AGENCIES ESTABLISHING GERMAN INDUSTRIAL SCHOOLS.

The agencies thru which the German industrial schools are established and fostered are of widely different character. Sometimes the creating agency is the state, sometimes a guild, sometimes an association, sometimes a commune or town, sometimes a private individual, and sometimes two or many of these combined. In general it may be said that the State participates most largely—or even exclusively—in the establishment and maintenance of those industrial institutions which aim to supply the best and highest grade of instruction, such as the great technical high schools, the commercial high schools (more properly called commercial universities, from the scope and breadth of their instruction), as well as some of the industrial art schools and large trade schools. Because of the necessity of spacious buildings, of a highly educated teaching force, and of the magnitude in organization and management which schools of this class require if their work is to be maintained on a modern and efficient basis, the financial burden is too great to be shouldered by guilds or individuals alone, nor is there incentive for such financial undertaking. The benefits of a technical high school come to the State at large, not to any particular trade or class of people. The logical agent to come forward and establish and maintain such institutions is therefore the State. Some of these schools also owe their origin to bountiful endowments by public-spirited men of means.

Schools of lesser importance are almost invariably organized and maintained by local guilds, industrial associations, or private individuals, with occasional governmental subsidies, as is well illustrated in Saxony, Hesse, Nassau, and Darmstadt. In Baden the industrial schools are, without exception, communal or town (Gemeinde) institutions with State aid.

*Abstracted from Daily Consular Reports.

An enterprising statistician perceived a good opportunity at the industrial school exhibition held at Dresden in 1898 for the collection of data as to the origin of Germany's industrial schools. The greatest diversity was found to exist. The 251 industrial schools which participated in the exhibition were founded by various agencies, as follows: 48 by the State; 47 by guilds; 88 by other industrial organizations and associations; 45 by the Gemeinde or town; 23 by private individuals.

The State promoted, in the main, the larger schools, the community the minor schools. Experience has proved the wisdom of preserving the lower industrial schools, and especially their financial administration, as nearly as possible in the hands of the local government or local trade organization. Such an arrangement draws them closely into the life and interest of the community. These schools are, as a rule, eminently local in their curriculums, their aims, and their general character. Their students come largely from among the inhabitants of the immediate vicinity. They supply skilled labor for the local industries. The consciousness of an immediate and direct financial interest and return is invigorating. It stimulates regular and full attendance and close application. It encourages the adaptation of the school to the changing needs and requirements of the locality. In brief, it keeps the school modern and alive to the call of industry.

LOCATION OF GERMAN INDUSTRIAL SCHOOLS.

The selection of the proper locality for the erection of an industrial school building has always been in important consideration in Germany, and has done much to create and maintain that intimacy and reciprocity in relationship between school and life to which reference has already been made. To be sure, a divided opinion probably never existed as to whether the weaving school ought to be located in the mining center or the mining school erected in the weaving center. But there are numerous other important considerations of expediency in the matter of location. Old records show that the German fathers had many warm discussions over the practicability of one place or another for the location of a contemplated trade school. It has also been the aim to place the school building as near as possible to the center of an industrial community, in order to give all equal chances to attend. One therefore frequently finds large and important industrial schools in comparatively small cities. The metropolitan idea is inconsequential in face of the call of industry. This location of the school affords easy access to the neighboring factories and workshops as a practical supplement to the work in the school. When it is remembered that almost all trade schools have special workshops or factories associated with the school building, it will be seen that the student during no moment of the period of his learning loses contact with the peculiarities of the industrial life in the surroundings of which he must later on work out his salvation. Obviously the question of location is vital only to the specialized trade schools and the commercial schools located in leading commercial centers and has little application to the great German technical high schools.

CHARACTER OF THE STUDENTS.

A very large majority of the students who attend the trade schools of Germany have had more or less preliminary training and practical experience in the trades in which they desire to perfect themselves. They come directly from the industries, and with the power of a wider knowledge of the new and latest developments in their trade, go back to them to bear witness to the wisdom of industrial schools by proving their strength and capacity as competitors in the world's markets. Industrial education needs a good soil if it is to flourish. The previous training, the foundation, both mental and practical, is half the making of the technologist. Entrance requirements in most of the professional trade schools emphasize the necessity of previous practical employment in the industry in which the students desire to perfect themselves. The length of time of previous active preparatory work required and the maturity of mind depends upon the difficulty of the trade and upon the grade and character of work offered in the school, and varies from several months to one year and more. Compulsory attendance is quite general in Germany. The young boy is given the choice of continuing his studies at the compulsory schools for general education or of entering an industrial school. This excludes the possibility of "cutting" an education. Since no young man, if he is sensible, will for an extended period of time engage in the study of an industry in which he does not intend to specialize, all who enter an industrial school are there for a purpose and with a clear idea of what they are about. No useless chaff finds its way into the study rooms, and the teachers are obliged to deal with none but genuine wheat. Such students are an encouragement to the teachers and an inspiration to each other. A visit to a trade school, with its intent learners, forcibly impresses one with the value of such a community of interest in giving an impetus to education and an incentive to vigorous competition, both of which are signally fundamental to industrial success.

CURRICULUMS AND METHODS OF INSTRUCTION.

The curriculums are the most important features of the school, and merit the most careful consideration. The curriculum and the method of applying it determine the success or failure of a school. Tho German critics see room for much improvement in the curriculums of industrial schools, it is manifest from the success of the young graduates that they

are already quite well adapted to the needs of the day. While a varying amount of general instruction must be given, and a foundation of the theoretical side of a trade laid, practical instruction and active work in associated factories or workshops preponderate. Here lies the secret of a large part of the empire's success. Such instruction is inestimably more valuable than to "learn to do by doing" in a father's or somebody else's factory, where a young man is merely an apprentice, standing largely upon his own uncertain feet. In the modern German trade school are found the most modern machines, the latest inventions and the most practicable methods. Every movement of the student is guarded, every act is followed, every mistake is corrected as soon as it happens by teachers who have had good preparatory training, who, in most cases, come directly from their trade, and who are fresh and up to date in their practise.

How different the situation of the young apprentice in his father's factory. He may be alone at his machine for hours at a time. He may commit a legion of errors without detection until the products of his experimentation are placed upon the market, as experience has frequently proved. He may have a negligent father; he may be trying to learn in an antiquated factory, with old-fashioned machinery and antique methods; he will very likely imitate his father, who may have imitated the methods of his grandfather. In contrast to this, what a wealth of opportunity is furnished in the modern workshop associated with a technical or trade school. Here the student may revel in the surroundings of the latest and best. He knows that he is arming himself with the keenest sword and is protecting himself with the most effective armor. It was the value of this practical work in the workshop of the school that was most generally questioned by the strongest opponents of the German industrial schools. It was this idea of bringing the spinning mill and the loom, the plow and the harrow, the steam engine and the locomotive under the hood of the doctor of philosophy and under the protecting arm of the forgetful, idealistic and unpractical professor that the enemies of industrial schools in Germany ridiculed and derided. But their gibes and sneers missed their mark. The progress of industrial education has borne eloquent witness to the need of it. The success of its scions in industry is daily vindicating it. The overcrowded recitation rooms and the rejected demands for admission are evidence that the people are calling for it. It is a victory of instruction in the teachers' factory over apprenticeship in the father's factory.

A few words more as to the curriculum. Drawing is pre-eminently in the lead. It lies at the basis of a large majority of advanced studies and is the A B C in the curriculum of many a trade school. As a former United States consul at Chemnitz, Mr. Monaghan, well says, in his able and thorough reports on industrial schools in Germany:

"The importance of this study may be seen in the many hours devoted to it, from the kindergarten to the university. No other study in technical schools gets so many hours or more careful attention. In day schools, evening schools and Sunday schools it is the same thing—drawing! drawing! drawing! It is an aid rather than an injury to the memory. It trains the mind as well as the eye. It is as great an aid to the reasoning powers as is logic or mathematics. It is the very essence of both. One is always dealing with relations, making comparisons, seeking exactness. Besides, a sense of the harmonious and beautiful is developed."

In mathematics, as in other studies, it is assumed that the student has grasped the fundamentals of the subject. Emphasis is placed upon accuracy, speed and simplicity. Most of the hours in arithmetic are devoted to technical computations, which are incidental to the special trade taught in the school. In geometry theoretical demonstrations give way entirely to practical applications of geometrical relations. What requires special attention here is that in the German trade schools work does not end with the purely technical side of the trade, which would place the graduate at the mercy of his inborn talent (or lack of it) for wise business management, but includes studies which prepare the student for the practical conduct of a business. He gets a good knowledge of production and consumption, cost, prices and market fluctuations in his trade; he learns the system of bookkeeping which is most practical in his business; he studies public legislation of importance to the industry with which he has identified himself; and, on the whole, he is given opportunity to acquire a good insight into concrete business relations and trade practice.

FINANCIAL SUPPORT.

At the bottom of all questions of administration is the hard fact of money. Nothing is of more determining importance than the finances of an institution. They fix largely its scope, breadth, and efficiency. A lack of resources means failure, no matter how laudable the aims of a school. Give a school money and unfailing resources and it will prosper long under the most untoward circumstances. German industrial schools are usually compelled to exercise the closest economy, and in many cases they suffer for want of adequate support. The lower schools, which necessarily are the most numerous, frequently lack proper rooms for the meeting of students, sufficient funds for the engagement of good teachers, and means wherewith to purchase the most essential schoolroom equipments. Their financial administration is an unending chapter of struggle. Their great number in certain parts of the Empire has dissipated energy, divided interest, and reduced support. The writer believes that too often guilds, other trade organizations, and individuals, instead of uniting for the maintenance of a smaller number of efficient schools, direct their enthusiasm and devote their funds to the establishment of numerous little local schools which, while they undoubtedly are valuable institutions and do much good, can probably not accomplish the results that could be attained thru the unification of effort and resources for the support of larger institutions endowed with sufficient resources, equipped with adequate schoolroom appliances, and administered under the numerous advantages incident to operations conducted upon a large scale. This criticism is not directed against the wisdom of maintaining certain small industrial schools for the re-enforcement of local industries, but is aimed more directly at trade schools, such as are found in the textile industry, which frequently duplicate each other in one and the same town.

The financial administration of a school can obviously not be clearly set apart from its general administration, as the former is a necessary element of the latter. Since the subject of the general supervision and administration of the German industrial schools will be treated in a separate paper and will involve the expenditures of the schools, the present discussion will be confined to their incomes—to the classes and sources of income and the methods of maintaining and expanding it.

The incomes of German industrial schools may be conveniently grouped under two heads—internal incomes and external incomes. The former represent the direct earnings of the schools in the form of tuition fees, entrance fees, and receipts from the sale of products manufactured in the schools and of materials to the students of the institution. The latter represent the financial aid and support given to the schools by the numerous outside agencies, such as the State, city, town, guild, trade organization, chamber of commerce, or individual.

Whether the external or internal income of a school is the more important depends entirely upon the nature of the institution; upon the number of students who attend; upon the nature of its origin, whether State or private; upon its organization; upon the voluntary or compulsory character of the attendance, and upon numerous other considerations. In general, it is probably true that those schools which are under public management and control are supported less by their internal income, in proportion to their expenditures, than are those schools which are under private management. The external incomes, in the form of subsidies, contributions, endowments, etc., are generally much larger than the receipts from tuition fees, entrance fees, and the sale of manufactured products of trade

schools. There are some schools, however, whose worth has been so generally recognized, which draw so large a number of students, and which are able to maintain such comparatively high tuition fees that their entire expenditures are practically met out of their internal receipts. A good illustration is found in the commercial schools of Saxony, which, under very economical administration, manage to defray 81 per cent. of their expenses out of the receipts from tuition fees.

The various agencies which give their support to industrial schools are very frequently represented in the managing board of directors in the same way as they appear as contributors to the school funds. A fitting illustration of such diverse representation in the management of a school is found in the case of the noted higher school for textile industry of Aix la Chapelle. In this institution the board of directors is called the *Kuratorium*, and consists of twelve members. One of these, the Regierungs-Assessor, represents the Prussian Government. Another, the mayor, represents the city of Aix la Chapelle. The rest represent the local weaving union and the local union for the promotion of industry and labor. A sub-board, consisting of six members of the Kuratorium and the director or immediate executive of the school, constitute a special body, Betriebs-Ausschuss, for the supervision of the workshop associated with the school.

It is customary in the administration of the German industrial schools to exact schulgeld or tuition fees from the students who attend. These fees are comparatively reasonable, and serve a good purpose in winnowing out for attendance those young men who have a firm determination to follow the trade which they come to learn. The exaction of schulgeld can readily be defended on many grounds. It is distinctly a case of paying the price, a very reasonable one, and taking what one wants. One pays for what one gets, and this is what we are accustomed to do in other walks of life. Nor does the student pay the entire bill of expenses of the school. There come to his aid the State, town, city, guild, private benefactors and others. To this extent the entire public pays for his special trade education. The schulgeld is a common feature of the complete German educational system. From the time the six-year-old child is trotted off with slate and pencil, the schulgeld calls for payment. Beginning with the trifling sum of 10 pfennige, or the popularly termed "Groschen" (2½ cents) a week for children in the country schools (dorfschulen), it gradually rises to marks, to hundreds of marks, yes, to a thousand marks in the most advanced industrial schools of the empire. As a rule, however, the tuition fees in the higher classes of industrial schools, like the high engineering schools and the higher technikas, or institutes of technology, range from 200 to 300 marks [$47.60 to $71.40] for citizens of the German empire. Entire release from a tuition fee in the attendance of common schools would be by far more justifiable than in case of industrial schools. The common schools are established by the State. They exist for the State, and are open equally to all the people. The trade schools, on the other hand, are special schools in which all are not equally interested, and the benefits of which come largely to a class of people or to a locality. Those who attend such institutions, and receive their special benefits, may justly be asked to pay for their privileges, as they do in other higher institutions of learning. Besides, the exaction of a tuition fee tends to impress those who derive benefit from these schools with the value of what they are getting. It also encourages attendance and studiousness, and indirectly, also, saving. In Wurtemburg it is reported that the industrial schools with fees have been more sought than those with free instruction. Fees were generally introduced in this principality as early as 1855. The view-point of the students in their attendance is said to have changed from that of coming as a mere courtesy to the teachers to that of coming and getting what they have paid for, and getting all they can.

To overcome any possible injustice that may be inherent in the schulgeld, thru discrimination against the poor, provision is made in many schools whereby needy pupils, whose straitened circumstances are patent and open to proof, may be required to pay but part of the tuition fee, or may be relieved of it entirely by vote of the board of directors, upon presentation of satisfactory evidence in support of the claim of destitution.

In many cases the amount of schulgeld is not the same for all students who attend one and the same school. Generally the tuition fee is graded on the basis of citizenship and residence. Where such gradations exist foreigners pay larger fees than do citizens of the German empire, and citizens of the kingdom or principality in which the school is located pay less than do citizens of other parts of the empire. Where schools are maintained by guilds or other trade organizations outsiders generally pay a larger tuition fee than do the sons of members of the organizations. The tuition fees also vary in amount with the different classes of schools, such as technical high schools, commercial high schools, engineering schools, textile schools and other special trade schools. Contrary to the statements of some writers on this subject, who claim that the tuition fees are highest in commercial schools, the writer has found that the textile schools and the higher engineering schools exact the highest tuition fees.

The tuition fees in the higher engineering schools do not discriminate against foreigners, but are the same for all students. In the institutions at Cologne and Dortmund the fees for the lower courses offered are considerably less than those for the higher courses.

When, as in case of the textile schools at Barmen, Crefeld, and Cottbus, the fee is given as 1,060 marks [$252.28], the 60 marks [$14.28] represent a special entrance fee exacted from foreigners, and the 1,000 marks [$238] is the regular tuition for foreigners. As is evident from the above, the tuition fees discriminate against foreigners only in textile and commercial schools and a few others. A small number of schools exclude foreigners entirely.

GOVERNMENT AID.

In Prussia the amount of money contributed by the government for the support of industrial schools is generally more or less determined by the organization and efficiency of the school and the material aid given by the local government. The financial condition of the town (Gemeinde) is also taken into consideration. When schools enforce compulsory attendance the amount contributed is generally larger than when they do not. Resort to this condition for subsidization has been the most powerful instrument of the Prussian minister of commerce and industry in introducing compulsion into the Prussian industrial schools, especially into the primary industrial continuation schools (gewerbliche Fortbildungsschulen). In the year 1897 the Prussian Government contributed the considerable sum of 1,428,784 marks [$340,051] for the support of sixty professional trade schools (gewerbliche Fachshulen), while the towns (Gemeinden) contributed 744,797 marks [$177,262]. In most cases the town is required to furnish the grounds and building, as well as the main equipment of the school, before subsidies are made for the running expenses. Even in case of the State institutions (Staatsanstalten) like the builders' schools (Baugewerkschulen), mechanical engineering schools (Maschinenbauschulen and industrial art schools (Kunst-Gewerbeschulen) the town frequently pays for a large share of the cost of construction, or even furnishes the entire building. This is probably a very wise arrangement, inasmuch as such participation in the promotion of industrial schools is apt to arouse and to strengthen the interest of the public in the welfare of the institution.

The entire plant of the B. F. Sturtevant Company has now been removed from Jamaica Plain to Hyde Park, Mass. The new works have nine acres of floor space and all the modern appliances.

A storage battery trust has been formed in Germany by the acquisition of all stationary storage battery manufacturing plants by the Accumulatorenfabrik-Act.-Ges. Hagen, in Berlin. There had been much competition and "ruinous price cutting."

Piston Rods of High Speed Engines.

BY ERNEST R. BRIGGS.

Engine designers owe a debt of gratitude to Professor Barr and his assistants for the careful way in which they have investigated the various parts of steam and gas engines and have derived constants from collected data for rational and scientific formulas.

In the use of these constants, however, the greatest care must be taken to see that the conditions are *exactly* similar, or what is apparently a large factor of safety may vanish entirely. In safe hands there is, of course, nothing to fear, but in the hands of irresponsible persons, to whom a little knowledge is a dangerous thing, disastrous results may follow. There is also the danger of compilers of pocket books finding in Professor Barr's investigations good "copy," using the scissors too freely and clipping away the particulars of the conditions under which the constants were obtained, before they use the paste.

As a case in point, take that of piston rods for high-speed engines. According to a summary given in *Engineering* for November 19 and 26, 1897, the formula is determined as follows:

Load on the rod =

$$P = S \frac{\pi}{4} D^2$$

where S = steam pressure and D = diameter of cylinder.

The resistance to buckling of the rod, taken as a strut, =

$$P = \frac{\pi^2}{4} \cdot \frac{E I}{L_1^2}$$

where E = modulus of direct elasticity, I = moment of inertia of cross-section of rod, L_1 = length of rod.

Putting $I = \frac{\pi}{64} d^4$ and $L_1 = K L$, where d = diameter of rod, K = a constant and L = length of stroke, then

$$S \frac{\pi}{4} D^2 = \frac{\pi^2}{4} \cdot \frac{E \pi d^4}{K^2 L^2 64}$$

$$\text{and } d^4 = \frac{64 S}{\pi^2 E} D^2 K^2 L^2$$

Before going further, it is necessary to consider the conditions under which the values for S and K were found. The American high-speed engine is a different machine from the English one. The former is invariably either simple or tandem-compound, and it is largely an auxiliary engine; the latter, on the other hand, is very often used as the main engine, and often drives generators up to 1,500 kilowatts, and it is, when double acting, either compound or triple expansion, but side by side, like a marine engine. The tandem-compound engine, not being a favorite, is rarely used. The English engine is also different from the American in that it is vertical and not horizontal.

The consideration of these facts brings forward two particulars in which the con-

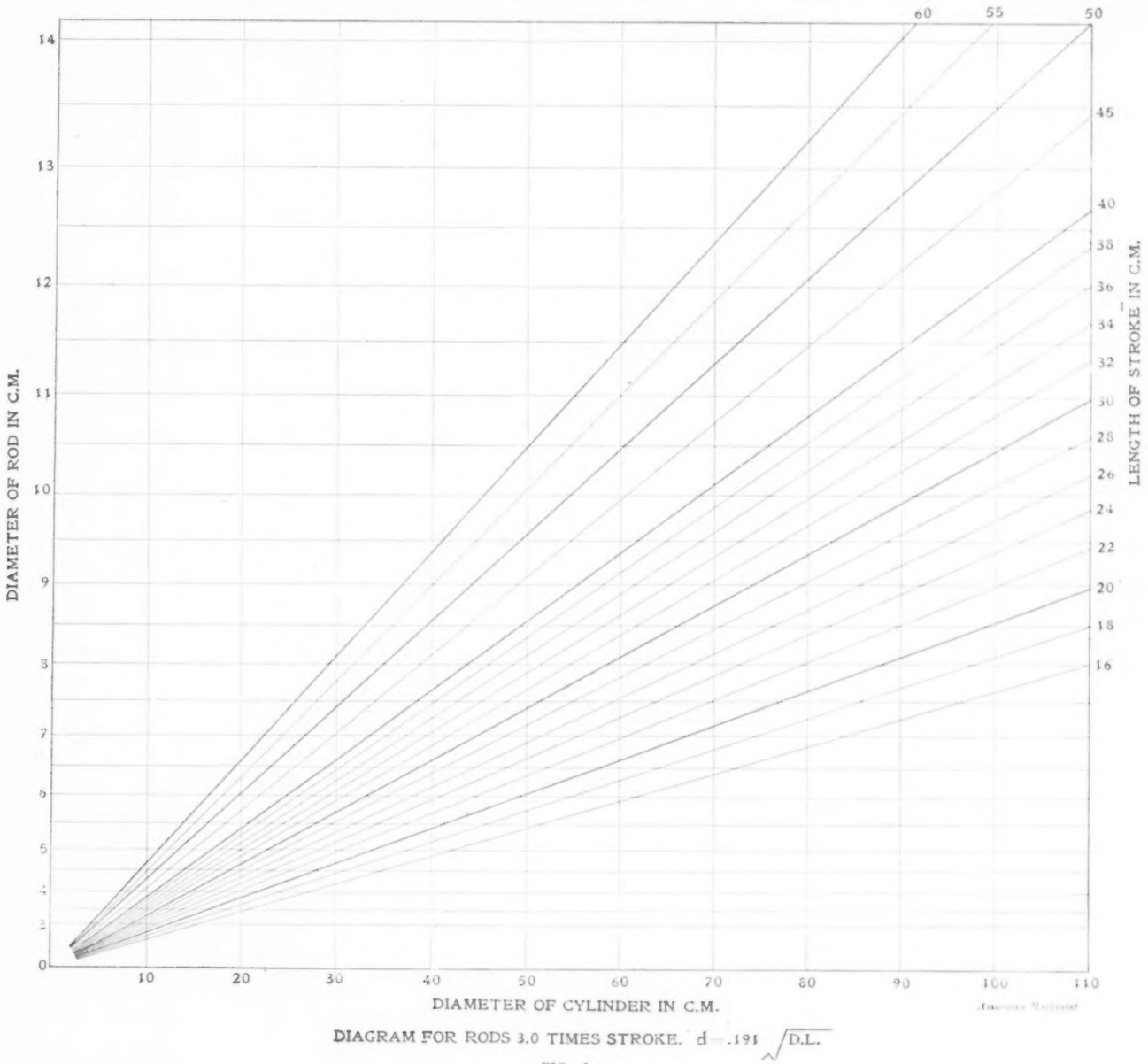


DIAGRAM FOR RODS 3.0 TIMES STROKE. $d = .191 \sqrt{D.L.}$

FIG. 1.

stants will need modifying before being applied to English practise. The steam pressure S has been taken at 100 pounds per square inch; for a tandem-compound or simple engine this is a good average, but not so for a side by side compound or triple engine. Here S will never exceed 70 pounds per square inch, as a high average, D being, of course, the diameter of the low-pressure cylinder in all cases. The second point in which the constant will vary is a much more important one—the length of the rod. It is certainly some-

com—causes several modifications to be made in the engine. It is necessary to place at the top of the crank chamber—*i. e.*, between the stuffing box and the crosshead—a gland of some description, to check as far as possible the creeping of the heavy mineral oil up the rods. This gland is sometimes a packed gland, but a better device is a white metal "scraper gland." The stuffing box of the cylinder is generally very deep. This is to a certain extent caused by the coned shape of the piston—like an umbrella—to facilitate

Having considered the differences, it is now possible to finish the formulas, taking E as equal to 30,000,000 pounds per square inch. Thus:

For simple or tandem compound engines ($S = 100$), $d = .068 \sqrt{D K L}$.

For compound or triple side by side engines ($S = 70$), $d = .062 \sqrt{D K L}$.

Introducing a factor of safety of 10, the constants become:

$$.068 \times \sqrt[4]{10} = .121 \text{ for } S = 100$$

$$.062 \times \sqrt[4]{10} = .110 \text{ for } S = 70$$

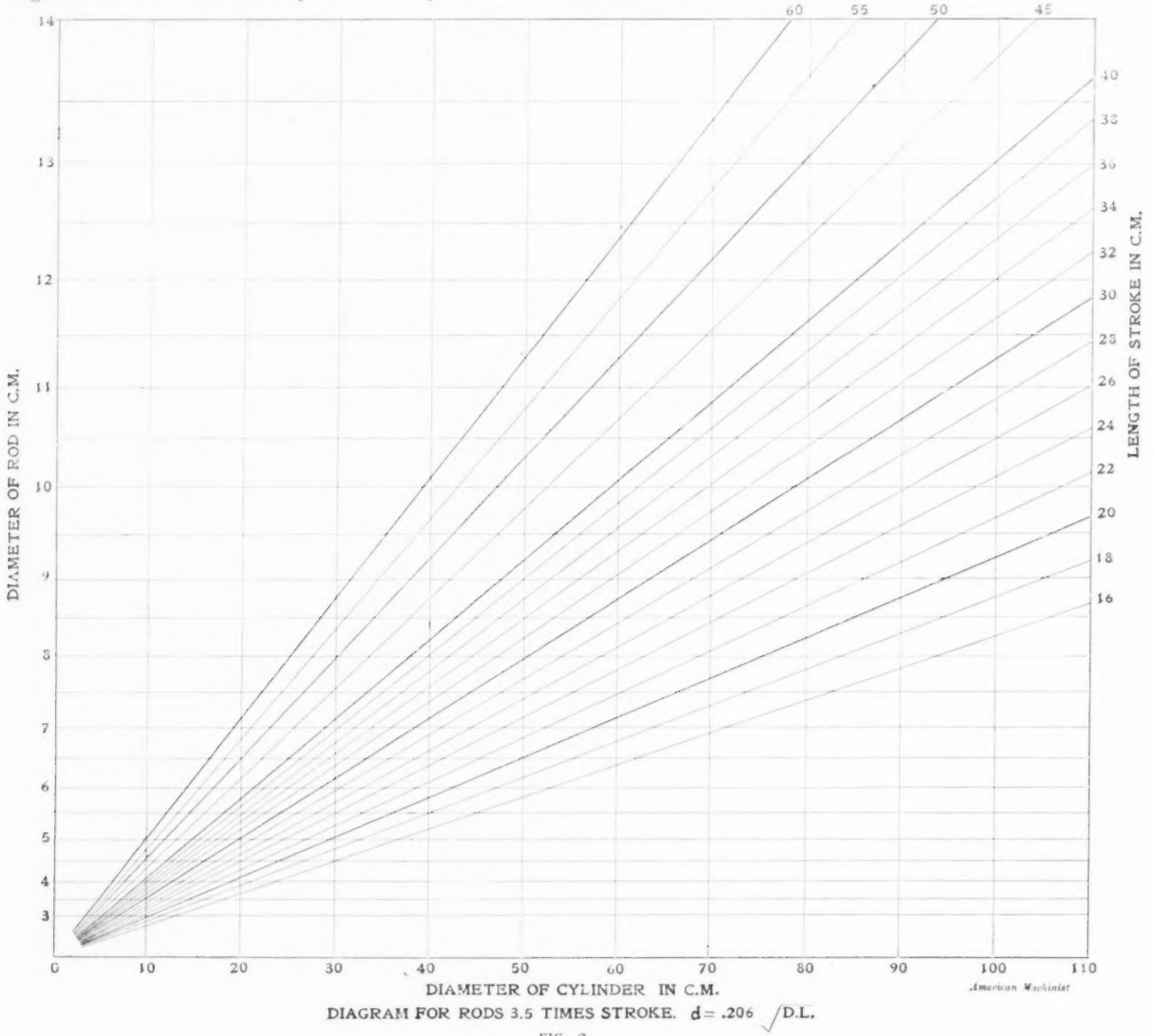

DIAMETER OF ROD IN C.M.
LENGTH OF STROKE IN C.M.
DIAMETER OF CYLINDER IN C.M.
American Machinist
DIAGRAM FOR RODS 3.5 TIMES STROKE. d = .206 √D.L.

FIG. 2.

what of a surprise to find that K has only an average value of 1.2 for the American engine. On the English engine, however, K is often as much as 4.0, and rarely ever less than 3.0. Why this great difference? It lies mainly in the different system of lubrication. The forced lubrication, which makes the high-speed engine so great a success—and indeed it may be said that there could be no high-speed double-acting engine without the system of forced lubrication first introduced by Mr. Mor-

drainage; but largely by the importance of providing a proper box when using high-pressure superheated steam. It is therefore customary to provide a metallic packed box nearer the cylinder and an asbestos packed one outside. In addition to these precautions, many builders are now providing a length of rod equal to the stroke of the engine, between the two boxes in the clear. This effectually prevents any part of the rod which goes into one box entering the other.

With different values of K; for $S = 100$:

$d = .210 \sqrt{D L}$ when $k = 3.0$

$d = .226 \sqrt{D L}$ when $k = 3.5$

$d = .242 \sqrt{D L}$ when $k = 4.0$

For $S = 70$:

$d = .191 \sqrt{D L}$ when $k = 3.0$

$d = .206 \sqrt{D L}$ when $k = 3.5$

$d = .220 \sqrt{D L}$ when $k = 4.0$

From these three latter cases ($S = 70$) the diagrams herewith have been plotted.

It should be noted that these formulas are perfectly general, so far as units go, and although the diagrams are marked in centimeters, yet inches, quarter inches or any other unit may be used, provided, of course, that the same unit is used for all three dimensions.

For $S = 100$ the formula has been given as $d = .068 \sqrt{DKL}$. Taking the average value of K as 3.5, d becomes equal to $.127 \sqrt{DL}$ for a factor of safety of unity; and taking the average constant given by Professor Barr, namely, .145, the factor of safety, should this be used where it ought not to be, would be only $\left(\frac{.145}{.127}\right)^4 = 1.7$, instead of 15, as it would be under the conditions for which it was given.

One firm of watchmakers in Switzerland takes annually from Sheffield 150 tons of steel for the manufacture of watch springs.—*The Engineer.*

Mr. Wicksteed's Impressions of America.

In English engineering journals we find an account of a meeting of the Institution of Mechanical Engineers in London, at which meeting President Wicksteed presided and "slides" were shown illustrating some features of the recent visit of the British engineers to America. Speaking of the visit here, Mr. Wicksteed said, in part:

Five short weeks spent by members of the Institution of Mechanical Engineers in the heart of North America fill the mind with delightful memories left by the cordiality of our hosts, the natural grandeur of the country, the exhilaration of the air, and the refreshing optimism of the people. The American Society of Mechanical Engineers, at whose invitation we crossed the Atlantic to join in their spring meeting at Chicago and to visit the exhibition at St. Louis, had also prepared lists of 200 workshops which were opened for our inspection, and which were probably of more engineering interest even than the great exhibition itself, for it is in the nature of an exhibition to show the results rather than the methods of production. Our introduction to works under the ægis of the American Society of Mechanical Engineers was therefore of the greatest advantage to us. It was very congenial to your president to have such a coadjutor as President Swasey, and it is a rather striking coincidence that the presidents of the two mechanical engineering societies of Great Britain and America should both be engaged, not only in the manufacture of machine tools, but of instruments for scientific use as well. Many members of the American society adjourned with us from Chicago to St. Louis, where we foregathered at the exhibition pavilion of the Royal British Commission. There Colonel Watson and Mrs. Watson received a large afternoon party to meet our members, and most kindly introduced us to all the chief officials of the exhibition. Subsequent to

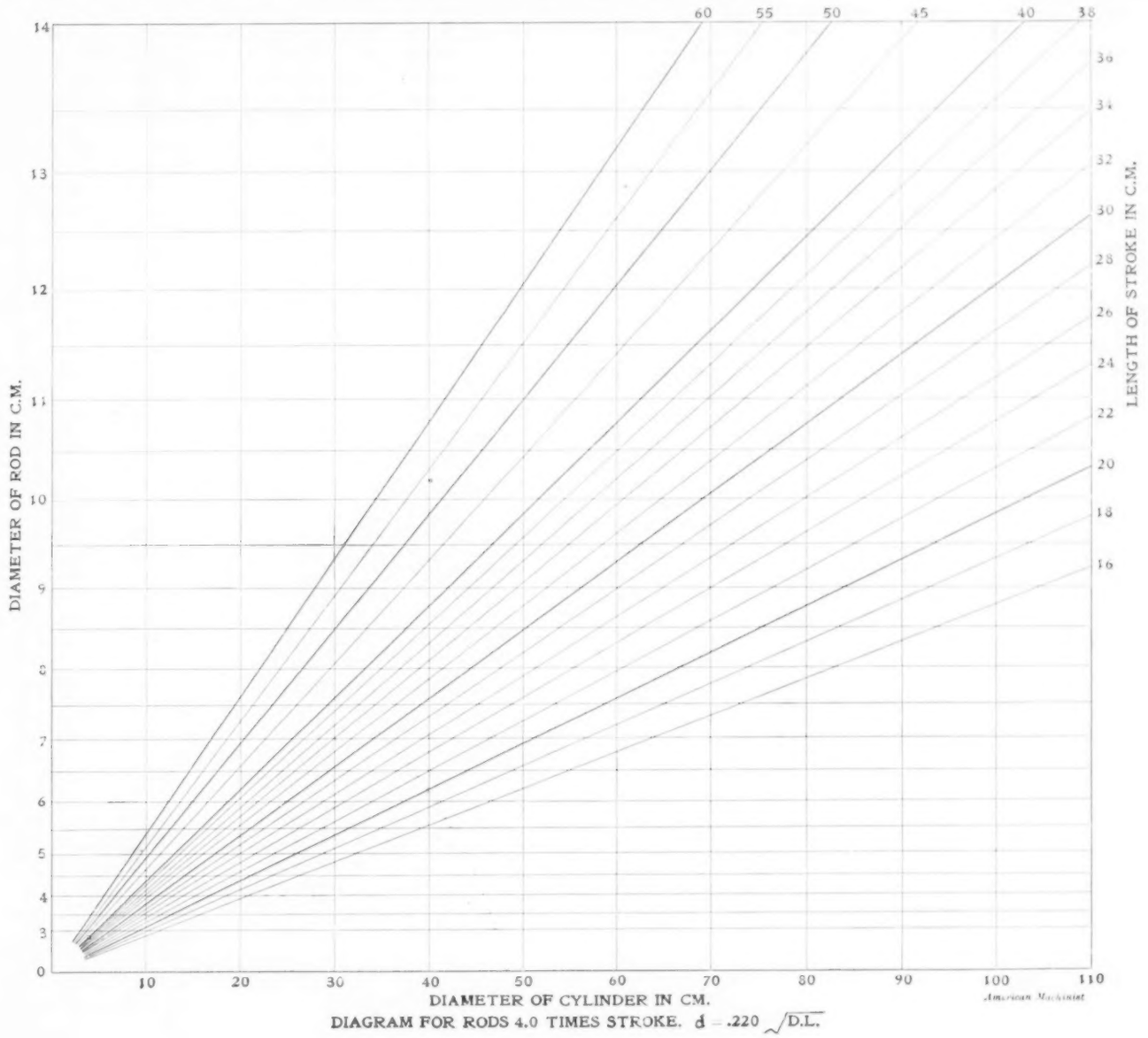


DIAGRAM FOR RODS 4.0 TIMES STROKE. $d = .220 \sqrt{D.L.}$

FIG. 3.

the exhibition we visited Cincinnati, where we had the pleasure of seeing a cylindrical milling cutter of quick-cutting steel running at a blue heat throughout its length, milling a long slot out of a cast-iron bar about 1¼ inches thick, and in no way losing its edge. Another curiosity in mechanics afterward seen by your president was at the Worcester Technical Schools, where Professor Albert Kingsbury had made a trunk piston 6 inches diameter, 6 inches long, weighing 60 pounds, to revolve in a cylinder with a horizontal axis without metallic contact; the trunk is supported by a thin film of air self-induced, and the coefficient of friction is only about one ten-thousandth. Our interest in the convention, the exhibition, and the workshops of America rose, as Professor Hutton remarked, in an ascending scale, and this description held good as to our interest in the natural beauties and resources of the country and in our acquaintance with the individual men themselves who are molding its development. The characteristics of works in the States are by no means stereotyped; for instance, Baldwin's well-known locomotive works are all in one group of buildings in the center of the city of Philadelphia. On the other hand, the American Locomotive Company has eight separate branches in different parts of the country, including one in Montreal, and the capacity of this firm is also seven locomotives per diem. Nor are engineering designs and methods in the States confined to fixed types, such as we are apt to associate with the title "American," and some tools of American origin with which we are made most familiar thru the columns of the engineering press, are not those which we find most largely adopted in the workshop practise of the country. Similarly the methods of training engineers academically by no means follow identical lines. At the Massachusetts Institute of Technology a student only devotes about a quarter of the time to workshop practise which he would do at the Worcester Polytechnic. At the latter place there is a real pattern shop, foundry, machine shop, and fitting shop, where the students learn to be skilled workmen, so that they can, and do, turn out several types of engineers' tools, which have a good reputation on the market, and sell freely. But the one thing in common to all the training establishments for engineers seems to be belief in themselves and their methods, and a large measure of success. Between the two extremes of methods there does not seem to be much to choose in the power of the country to assimilate the product. The Americans at home are far too shrewd to discard a system purely because it is old established. We had the pleasure of a trip on a Mississippi steamer. We went 20 miles up stream, and saw the junction with the mighty Missouri. This treat was given to us by the Engineers' Club of St. Louis. The steamer had side paddle wheels, with a single cylinder working thru very long wooden connecting-rods on to an overhung single crank on each paddle-wheel shaft. Either cylinder can be reversed separately by primitive hand gearing. The system is old, but it is suited to the conditions of navigation in the Mississippi. In this connection it may be mentioned that the Cincinnati engineers gave us a trip down the Ohio on a stern-wheel steamer. Two horizontal cylinders drove it with very long wooden connecting rods. There were three wooden rudders between the paddle wheel and the stern of the boat. At Lowell and Manchester, where are great seats of the cotton manufacture, the whole stream of the Merrimac is twice diverted from its channel, and twice within 20 miles the whole volume of its water is used for power. There is also about an equal amount of power for the mills generated by steam, and the prevailing scheme is to have a number of turbines combining to drive a long, heavy, flywheel shaft in the basement thru bevel wheels. The end of this shaft is driven by a large steam engine. This controls the speed of the shaft by supplying whatever balance of power is required. Steam engines are more sensitive to the control of governors than are turbines, so the engines respond promptly to the small and large variations in the demand for power in the mill. The ramifications of cross shafts and parallel lay shafts driven by bevel gear and by belts from the first long, heavy flywheel shaft are very extensive. It is needless to say that the development of electric transport in America is huge, and consequently the works for making electrical equipment are huge also. One of the works which we were privileged to see was that of the General Electric Company at Schenectady, interesting alike from the buildnigs, the equipment, and the electrical machinery produced. American cities vary from each other very greatly; for example, Washington is a city of residences and public buildings throughout, St. Louis is a city without a residential quarter because it has absorbed its own suburbs, and so on; but all which we saw are alike in being so well served with tramways that you may go from within a block or two of any one part of the city to any other, and frequently far into the country, and even to towns and villages 20 miles away. Under these circumstances, and with cities like St. Louis, doubling their population every ten years, there can be no wonder that the rolling mills and engine works of America have busy times. Our hearty thanks are due, and are hereby tendered, to our American cousins, whose kind attentions throughout our visit have made us feel kith and kin. The New York banquet of President and Mrs. Swasey, our reception at Chicago headed by Captain and Mrs. Hunt, the concert given by the Local Reception Committee at the magnificent Auditorium Theater of that city, the fraternal hospitality of the engineers' clubs—which are a notable institution in most of the cities we visited—also the Country Club, with golf links at Cincinnati, lunch at the Derryfield Club, Manchester, and the "Longshore" luncheon at Shirley Point with the Boston contingent of our hosts, all made us feel welcome to the United States of America in the most agreeable manner, to say nothing of a 40 miles' drive in a White's steam motor round the beautiful suburbs of Boston on the best of macadamized roads, which your president and Mrs. Wicksteed enjoyed in company with their kind hosts, Mr. and Mrs. Boyd. Nor was Canada behind in extending a welcome to us. The engineers of Montreal, led by Mr. Lacey Johnson, organized visits for us to the fine new works of the Canadian Pacific Railway, the laboratories of the McGill University, and the works of the American Locomotive Company, and the Engineers' Club, with their president, Mr. St. George, spread its hospitable board and threw open its rooms for our benefit. To have sailed on the Mississippi and the Ohio, Lake Ontario and the St. Lawrence, to have stood on Mount Royal, sailed on Boston harbor and New York harbor, on Lake Champlain and Lake George, to have seen Niagara and its power stations, would all have furnished memories worth while the spending of five short weeks, but to have had friendly intercourse with a nation whose language is our own, and whose kindness and cordiality seem to be modeled on the same large scale as the land in which they live, is an experience which enlarges the outlook of one's whole life. To them is given this meed of praise, and for their names, they are recorded in our minutes.

At the request of the president, Mr. Spencer rose to express the thanks of the Institution to their American brethren for the unceasing kindness and courtesy with which the visitors had been treated. Of this Mr. Spencer gave more than one illustration. Continuing, he said that he found that the dominating idea in the United States was big output. Much had been said about education, energy, and so on, but the success attained at the other side of the Atlantic seemed to be in the main due to the courage with which capital was invested to attain an immense output. This was the key to the situation, the point on which everything turned. On every side was found evidence of magnificent enterprise. Nor must the energy of the workingmen be overlooked. What was the cause of all this remained to be explained. It was of the most striking character, and a peculiar feature was that in all the works the leading men, managers, foremen, and such like, were English or Scotch, Irish or Welsh. For much of our own troubles he held that the action of the trades unions was responsible, because they deprived the workman of the chance of rising above his fellows in a way that was quite without parallel in the United States. He would, in conclusion, say that most of the statements he had made were the result of

information supplied him by Americans, and he strongly advised the members of the Institution to avail themselves of any opportunity that turned up and visit the United States, where they would be heartily welcomed.

Simplicity in Experimenting.

When the memorial to Sir George Stokes was unveiled, the other day, Lord Rayleigh held up as an example still to be followed the simplicity of Stokes' experimental methods and the limitation of his apparatus to the bare essentials for the demonstrations he had in view. Prof. George Darwin has well said that people are nowadays too apt to think that science can only be carried forward with elaborate appliances, and yet many of the finest experiments have been made with cardboard, cork, and sealing wax. Modern science has rendered necessary for many investigations highly expensive instruments, and great laboratories are required for college purposes, but, observes Prof. Darwin, "the number of great investigators has been but little increased by laboratories, and those who are interested in science and have not access to laboratories should not give up their study in despair." There are gentlemen living to-day who have spent almost as many thousands as Newton and Stokes spent pounds over their apparatus, and yet up to the present have not far eclipsed the two Lucasian professors.—*London Telegraph.*

General examinations to be held by the New York State Civil Service Commission on September 10 are to fill, among others, the following positions: Architectural draftsman, assistant steam engineer, bridge draftsman, fireman. Applications must be made not later than September 3. Particulars and application blanks may be obtained from the Chief Examiner of the Commission, Albany, N. Y.

Letters From Practical Men.

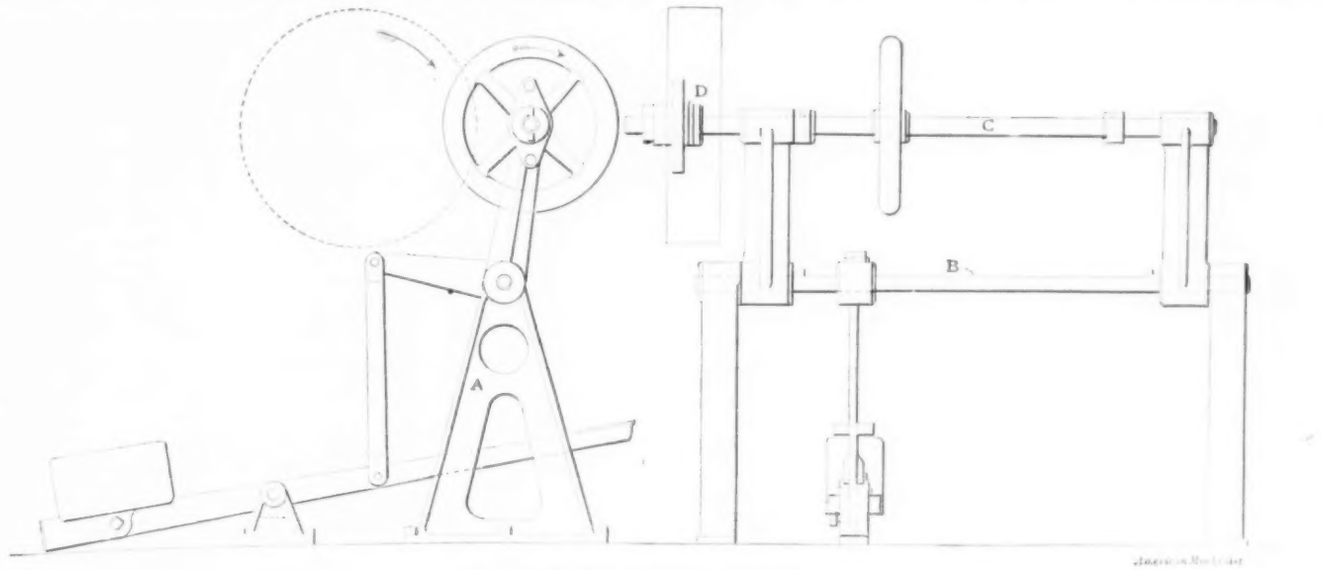
Gland Flange Grinding Fixture.

Editor American Machinist:

The illustration of the gland flange grinding fixture is a well tried, simple attachment to an ordinary emery wheel grinder. The fixture has been used for a long time in a large pump manufacturing establishment, and meets all requirements. The gray-iron standards *A* are bored to receive rock shaft *B*, and between the standards *A* are two arms parallel to each other that are bored at their ends to receive the gland holding shaft C. The drawing shows a gland in position to be operated upon. Keyed upon the rock shaft is a third arm at right angles to and located between the work-holding shaft arms. This third arm is connected by a split-end tie-rod to a foot-lever. It will be noticed that the foot-lever has a bearing back from the tie-rod, and when the foot pressure is applied to the outer end of the foot-lever the work-holding shaft is moved toward the emery wheel (dotted lines). It will also be noticed that the foot-lever has a weight at its inner end sufficiently large to cause the vibrating work-holding shaft *C* to recede from the emery wheel the instant the foot has been taken from the foot-lever, and the removal of gland is accomplished in safety. A hand-wheel of liberal size is fastened between the arms upon the work-holding shaft to furnish means for the operator to turn the shaft and gland while being ground. The work-holding shaft has a collar against which the gland is forced by means of a key, the removal of a key being a quick way of releasing the work from the shaft. *D* are filling-in washers, as the lengths of glands vary; bushes are furnished to suit the work-holding shaft, and the various sizes of holes in the glands.

It will be noticed that two stop-collars allow an end movement to the work-holding shaft; this is so that the wheel may get an equal amount of wear over its entire face. The movement of the work-holding shaft being at the will of the operator allows him to go rapidly over the smooth casting surface or linger upon the rough spots, such as unchipped gates, etc.

The mechanical talent required to operate this fixture need not be of a very high order, and after a few moments of instructions a "raw recruit" can handle the work quite satisfactorily. BECK.



GLAND FLANGE GRINDING FIXTURE.

Surface Grinding.

Editor American Machinist:

The parts of a gage had just come up from the hardener, and had to be ground and lapped—no time to season six months, or six hours.

One observing lad said: "The piece you did before you didn't hammer; what are you hammering that one for?"

The answer was: "I could control the first piece with the wheel; this piece I am hammering I couldn't." Or, to make it plainer, the first piece would come concave on the face the wheel was cutting, when taken from the magnetic chuck; but it would be parallel. Now, my theory is, that a wheel when cutting heats the surface up to a white heat, and the heat is instantly absorbed by the body of metal, which causes a tension on the face which pulls, consequently it assumes a slightly concave surface.

I put the first piece concave side down on a lap which was slightly convex, gave a few rubs, which removed the strains on the surface or eased them until they balanced the surface strain on the other side, which was pulling the other way.

The piece he saw me hammering came concave on the same side of the piece, no matter which side I ground on; so a good hammering on the concave side fixed the steel so it would act like the first piece. And instead of using the lap to straighten the piece, I used a smooth, bright, slightly

convex hammer face to peen the shrinkage strains out, using it very lightly. I prefer the hammer on work that has not got to be lapped; it does not show, and the effect is just as lasting, as far as I can see. Straightening with the lap leaves a poor-looking surface; it shows up the effects of the wheel, altho the wheel marks are only 0.0001 inch deep, which is all I leave to lap, and this piece had to be finished on a lap.

Now, is my point well taken? A piece comes from the hardener with strains in it, and you put strains in by grinding and lapping, which you can't help in the majority of cases (altho I have worked steel when it didn't seem to distort in grinding or lapping). Now these strains are practically unavoidable. I put strains in a piece by peening to counteract the existing strains, or balance them, which is all that seasoning six months or more does for it.

I have got a rectangular block, 4x2x2 inches, with a 1⅜-inch hole thru lengthwise, and can say that I have tried all kinds of seasoning for the last three years, and it goes whenever it feels like it yet.

When I got it from the hardener I rough ground it square, which means it was tested by a square that was square (and thereby hangs another tale). The block was placed outside of my window, left there all winter packed in vaseline, was all out of shape in three months, so was reground and replaced outside. It got to be warm weather; the block was examined, found as bad as it was before, was reground and seemed to stay, so I lapped it up square, and have been chasing up the distortions for the last year and a half, and can say they are slight, but they can be found easily enough.

Heat all hardened steel until water skitters, but does not boil, before grinding.

We tried all grades of emery wheels, and found Norton grade "G" No. 46 emery, 7 inches diameter, ½ face, the coolest wheel for thin, hard steel and gray iron; on soft steel it loses its size. The feed will have to suit the work. We used it for roughing and finishing flat surfaces, and can say that on fine gage and fixture work, in connection with a magnetic chuck, it works fine.

We grind composition with a wheel 7 inches diameter, ½-inch face, grade "I." emery No. 120, using a pair of pinch parallels to hold the work on the magnetic chuck, and taking a light cut and wide feed.

Water in surface grinding is of no use for keeping work from distorting permanently, but is all right to keep heat down. A free, cool cutting wheel is the secret of non-distortion. SCOTTY.

Turning a Motor Shaft.

Editor American Machinist:

Fig. 1 shows the shaft of a 5 horsepower alternating current motor. This is an example of some work that I am doing on a 2x24-inch Jones & Lamson flat turret lathe of the old design. The time required to turn this shaft would no doubt be better if done on the new design of lathe, with its new tool-holders. The time under present conditons required to turn it with an allowance of .005 for grinding (except the pulley end *D*, which is turned to standard size) is 35 minutes. As different operators of this lathe have different ideas and methods for doing this kind of work, it may interest your many readers to know of the method that I employ to get these results. To begin with, the stock is cut off to the required length, which in this case is 25⅜ inches, at the same operation the shoulders are cut on the ends to within 1-16 inch of the finished sizes of the shaft (see Fig. 2). These shoulders on the ends are cut to give the turning tools an easy start on the stock. In doing this the tool removes this 1-16 inch, leaving it round and true. This part enters the back-rest before the turner starts in the deep cut at the shoulders, thereby supporting the part being turned.

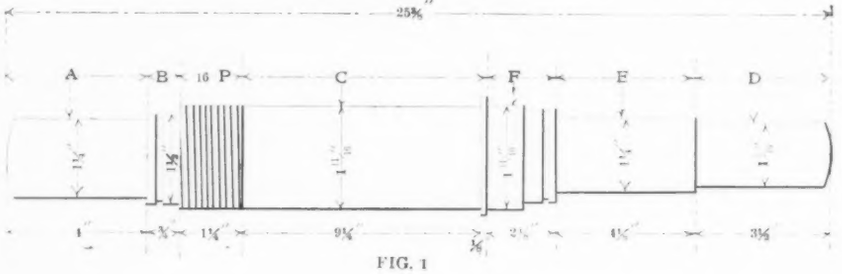


FIG. 1

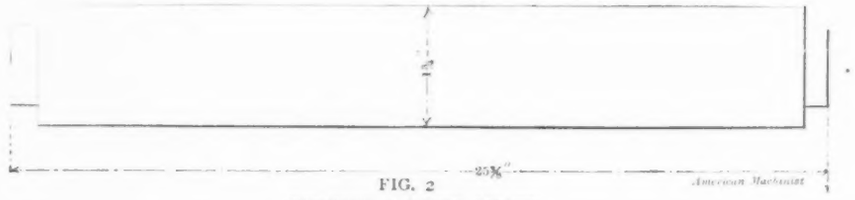


FIG. 2

TURNING A MOTOR SHAFT.

This results in its being true. The stock is then cut down the required length, when the automatic stop is set for this turner, one cut reduces the stock to the required size shown at *A*. The shoulder *B* with oil groove is turned with a formed cutter held in cross-slide, a bushing that fits the hole in the cross-slide casting is bored the same size as the turned part *A*. This supports the shaft while *B* is being turned and prevents any chatter or springing of the next part to be turned, which is shown at *C*. To start this cut true with *A*, I slip a collar over *A* that is bored to fit *A* and turned to the diameter of *C*. This collar is about ¾ inch long, and gets a bearing in the back-rest of the tool-holder before the turner starts to cut *C*. As the stock is now well supported it is only necessary to throw in the feed and turn the required length. This insures *C* being true with *A*. The automatic stop is now set. I next center the end *A* with a combination drill, and countersink set in the regular centering head furnished by the makers of the lathe. This is provided with rests that support the end being centered, and insures the center being true with *A* and *C*. The stop being set for this, the next operation to cut is the thread shown, which is done with their No. 6 automatic die-holder. This last operation completes the turning of this end of the shaft. I grip the finished part *C* and turn up *D* the required length. In turning *E I* proceed the same as for turning *C* by slipping a collar bored to fit *D* and turned to finished diameter of *E* over *D*. This collar gets a bearing in the back-rest of the tool-holder as described in the turning of *C*. *F* is turned with a formed cutter held in cross-slide with shaft supported in bushing of cross-slide at *E*. The end *D* is now centered as described before. One end of this shaft is turned thru the whole lot of 50 before doing anything on the other end. An accurate and smoothly running shaft is very desirable in this type of motor which runs at 1,800 revolutions per minute, finishing by grinding being the only way to get the best results from such a shaft. The reason for cutting the stock off the required lengths instead of turning them from the bar is that the stock as a rule is more or less bent, and as part *C* is but 1-16 inch smaller than the rough stock I had trouble in getting part *C* true enough to turn; by cutting off from the bar I have a chance to straighten the pieces in a screw press provided for this purpose. Also, as quite a lot of stock is removed from the parts *D* and *E*, and as one end of the stock may be straight and the other end bent, I have the opportunity to turn the parts *D* and *E* from the bent end, which I would not have if made from the bar. The time required to grind this shaft to within .001 limit of sizes is 15 minutes on a Landis machine with a carborundum wheel, grain 365, grade M. JOS. H. BLAIR.*

Grinding Fixtures for the Lathe.

Editor American Machinist:

The two grinding fixtures shown herewith were made to be used in a 13-inch

* Foreman Century Electric Co., St. Louis, Mo.

lathe, the drive being obtained from an overhead drum. Fig. 1 shows the construction of the internal grinder. The spindle *A* is made of unannealed tool steel and is lapped to a close running fit in the bushings *B*. The bushings are made of glass hard tool steel, ground inside and out, and are made a wringing fit in the holes in casting *C*, which is of gray iron.

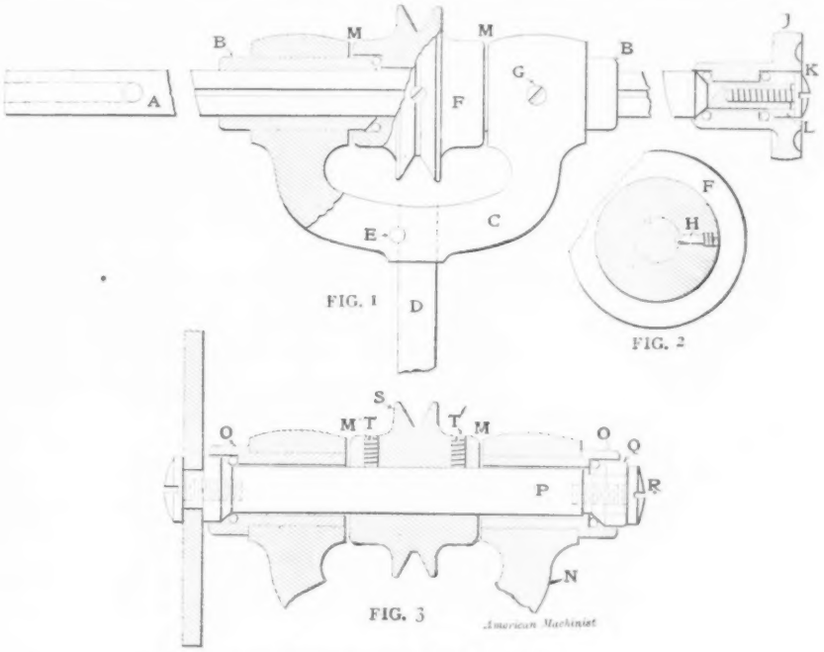


FIG. 1 FIG. 2

FIG. 3

GRINDING FIXTURES FOR THE LATHE.

The shank *D* that goes in the tool-post is made of ½x1-inch tool steel and has at one end a ½-inch round tit that is driven tightly into a hole in casting *C* and then pinned fast by taper pin *E*. The pulley *F* is made of case-hardened machine steel and ground in the ball races. The pulley is alike on both sides, and both bushings are alike, altho only the left side is shown in section. The adjustment for the ball bearings is obtained by sliding the bushings endwise thru the casting *C*, and securing each with a set-screw, one of which is shown at *G*. The spindle, shown in cross-section in Fig. 2, has three equidistant splines milled nearly its whole length, and is driven by the tempered pin *H* entering one of these splines. *H* has two flats milled at the end that enters the spline, so as to give a good bearing, and with the same object in view it was made an easy fit in its hole in the pulley, so that it would automatically line itself up with the spline in the spindle when the device was assembled. The pin is prevented from coming out by a headless set-screw which fits tight in its thread. Of course, only one spline is used with which to drive the spindle, but three were put in to enable it to be in balance at a high speed (6,500 per minute). Two diametrically opposite splines would have balanced it just as well, but three were used, as it was thought the spindle would spring less when they were cut. This, however, is merely an opinion. The bore of the pulley is slightly larger than the diameter of spindle *A*, so as to avoid all side thrust due to the pull of the belt, which is considerable at high speed, and which in this case is taken entirely by the balls. The spindle is traversed back and forth by the knob *J* which is made of case-hardened machine steel and ground in the ball races. The adjustment for wear in this part is made by the large head-screw *K* which forces the conical sleeve *L* on to the spindle. The threaded part of *K* is rather long and a good tight fit, to prevent all possibility of its backing out. *L* has a pin (not shown) which engages with a short spline at the end of the spindle, so they both have to rotate together. *J* was originally made as shown in Fig. 1, but after a little use it was discovered that it had an uncomfortable feeling when grasped by the hand, so the disk-shaped portion was turned off, leaving it perfectly cylindrical on the outside, after which it was nurled. It then felt all right. Spindle *A* is 13¼ inches long over all, and may be traversed 6½ inches. It has a taper hole in the left-hand end for the reception of the emery-wheel arbors that are used on the cutter grinder. The intention originally was to place felt washers in the spaces *M* to keep the grit away from the bearings, but the fixtures have had considerable use without them, and no apparent damage has been done to the bearings. However, they may eventually be put in.

The external grinder is shown in section in Fig. 3, its main casting *N* being a duplicate of *C*, but in this case the hard steel bushings *O* are forced in to stay. The spindle *P* is made of unannealed tool steel, and has a sleeve *Q* feathered to its end to take up the wear in the ball bearings by means of the screw *R*, which fits tightly in its threaded part. The pulley *S* is secured to the spindle by two headless set-screws *T*, the traverse in this case being obtained by moving the lathe carriage. The spindle is hardened at its left-hand end, and sleeve *Q* also is hardened so as to have hard cones for the balls to bear on.

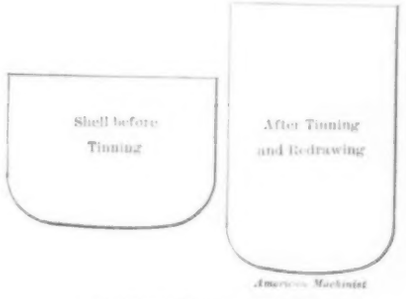
EDWARD N. ANDREWS.

Tinning Brass Shells.

Editor American Machinist:

A few weeks ago we received an order from a chemical company in Boston for 50 gross of brass shells (see sketch), the shells to be 2½ inches in diameter, 5 inches long, thickness of wall 1-32 inch. With the order came the request for the insides of the shells to be coated with tin to prevent contamination, as they were to be used for holding liquids. The method employed for producing such shells may be unknown to many, for the reason that there is no great demand for shells of this kind; the method itself, however, is not new. We filled this order in due time, the tinning of the inside of shells and the redrawing to finish size being done as follows:

Before redrawing the shells to finish size they were taken to the dip room, where they were cleaned and dipped, to facilitate tinning, after which they were taken to the soldering room. Here a pot of molten tin was kept at a constant temperature by the aid of a gas furnace. The insides of the shells were then moistened (not too much to avoid splashing) with soldering acid, after which they were filled with the molten tin. As each shell was filled the tin was emptied back into the pot, leaving a coating of tin attached to the walls of the unfinished shells. After the shells were tinned in this manner they were taken back to the pressroom, where they were redrawn to finish size. This gave



TINNING BRASS SHELLS.

us a fine finished shell, the shell being as smooth in finish and appearance on the inside as on the outside.

C. F. EMERSON.

Triple Gearing for 28-Inch Lathe.

Editor American Machinist:

The following is a description of a triple gear which I designed some little time ago for a 28-inch lathe built for the Philadelphia & Reading Railroad, the head of which lathe is shown in the photograph Fig. 1. The requirements were that there should be a minimum of expense both in pattern and machine work and that the

device should be handy and effective. These results were attained in a good measure by the means given below.

As shown in Fig. 2, the spindle was made the same as for a standard lathe, except that at *A* it was made the same size as for the front bearing, so that the spur gear *B* could be slipped on and off over the nose of the spindle. At *C* the flanged sleeve *D* was keyed on permanently. A new spider was made for the large end of the cone with a hole large enough to run on the outside of *D* instead of on the spindle, as usual. The gear *B* runs loose on the spindle. Back gears *E* were left as usual, having a ratio in this case of 12 :1. The peculiar feature was the lock-nut at *F*, of which a larger section is shown at Fig. 3. This lock-nut clamps in a radial slot in the flange of *D*, and when loosened may slide out so as to engage the internal flange *G* of the cone pulley, or may slide in so as to engage a notch in the face gear at *H*. This lock-nut is made with a square hole clear thru it to which is fitted a wrench, Fig. 4. The wrench is slipped into place thru opening *K* in gear *B*.

When lock-nut *F* engages the cone, then the later drives the spindle direct. When the lock-nut engages *B* and the back gears are thrown in, the action is the same as with ordinary back gears, gear *B* driving the spindle. When the lock-nut is left in its middle position, as shown, neither the cone pulley nor the gear is directly connected to the spindle. If we throw in the triple gears *L* and *M* by means of the eccentric bushing *N* by which they are carried, the action is as follows: The cone pulley runs loose; the back gears drive gear *B* (also loose on the spindle), in this case one revolution for every twelve of the cone; gear *B* drives gear *L* and pinion *M*, and the latter drives the spindle thru the medium of the face-plate and its attached gear. The ratio thru these last gears is 17:7, making a total ratio of 29:1. This ratio of course could be very readily

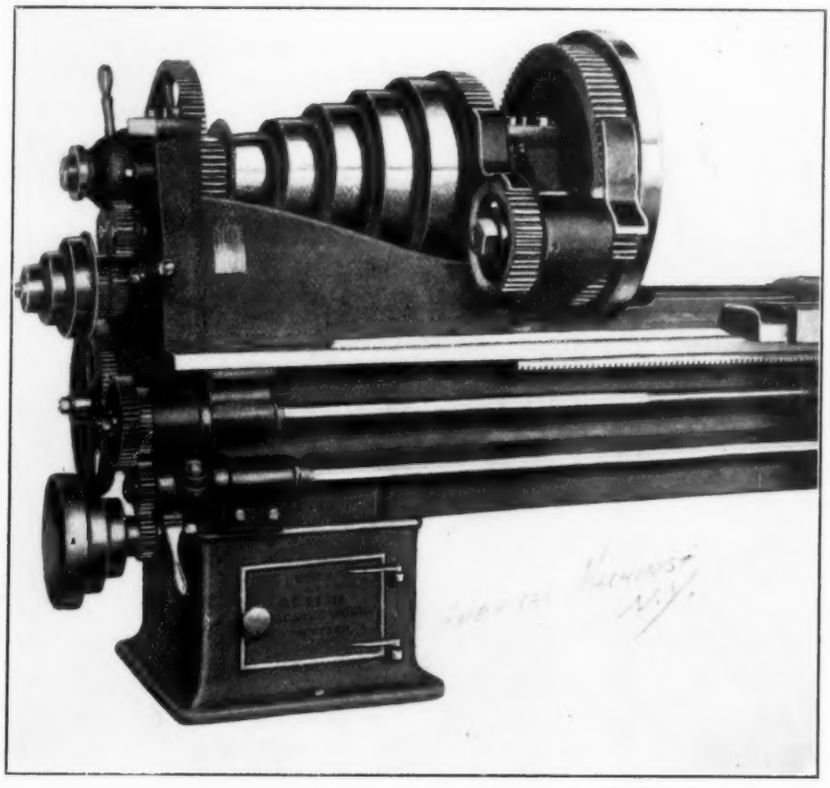


FIG. 1. HEAD OF 28-INCH TRIPLE-GEARED LATHE.

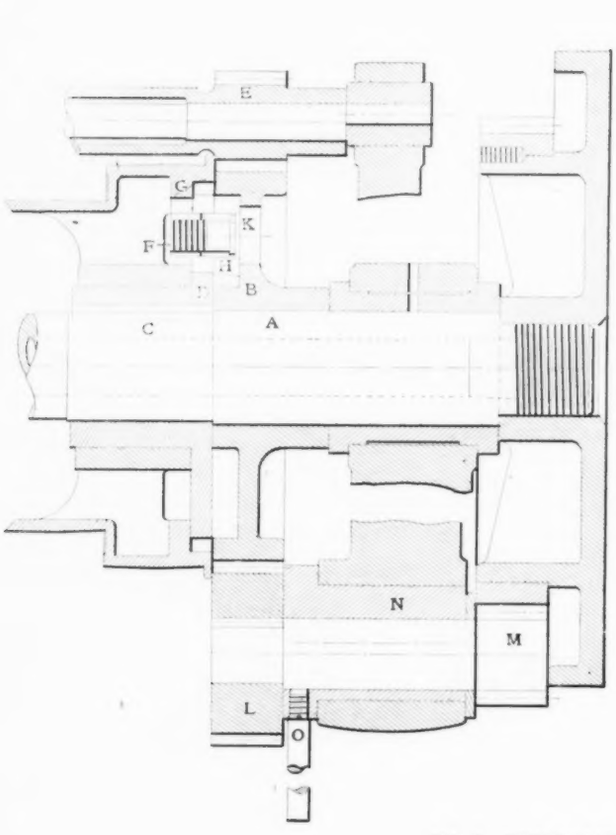


FIG. 4

FIG. 3

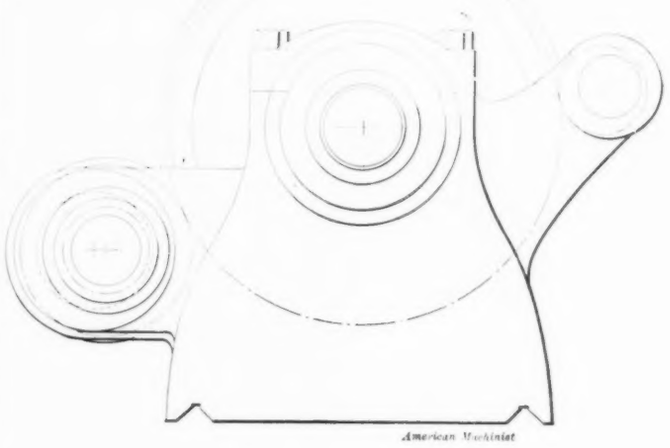


FIG. 2. TRIPLE GEARING FOR 28-INCH LATHE.

changed in the design; in fact, this design lends itself to varying ratios more readily than either of the usual methods.

The photograph shows that this works out into a very fair looking job. It is handy, as all adjustments are made from the front of the machine, and it is no more work to find and adjust the lock-nut *F* than when made in the usual form.

The new patterns required were the flanged sleeve *D*, gear *B*, gear *L*, eccentric bushing *N*, gear ring on the face-plate. A new spider was made for the cone and a loose ring was set on the face-plate pattern to make a ring to which to attach the gear. The projection for the triple-gear bushing was put on the regular headstock pattern as a loose piece and this was the only change made in the headstock.

E. H. FISH.

Making Atomizer Tips.

Editor American Machinist:

A large quantity of tips for piston pump atomizers had to be made cheaply, and having no screw machine with which to make them, the rather primitive tools shown herewith were improvised for the job, and with these, and a lathe to revolve the brass rod of which they were made, a boy was able to turn out over 1,100 per day of 9½ hours, making them by piece work. This did not include drilling the small hole .015 inch diameter, as that was done in another operation. One of the advantages of making the tips in this way was that no expensive machine tools were locked up while the job was not in progress. It frequently became necessary to

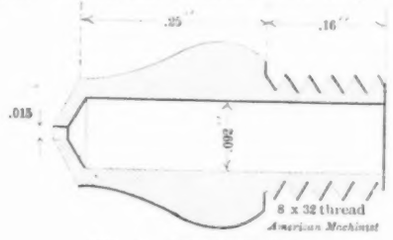


FIG. 1. ATOMIZER TIP.

stop this work and shift the boy on to some other job, and then the lathe was instantly available for other work; yet no time was lost in "setting up" every time the boy was ready to go ahead with the tip job.

Fig. 1 shows an enlarged sectional view of one of the tips. They were made of ¼-inch round brass rod, a piece of which was allowed to project from the lathe chuck about 18 or 20 inches. The lathe was started, and the tool shown in Fig. 2, held in the boy's hand, was pushed on to the end of the rod. It consists of a rather long sleeve that is an easy fit on the stock rod, this sleeve having a hollow mill secured in it by a set-screw, and the hollow mill in turn having a flat drill secured in it by another set-screw. The hollow mill reduces the stock rod to the proper size for an 8x32 thread, while the flat drill centers the end, so the twist drill of the next tool will start in true. The sleeve in Fig. 2 has two oblong holes in its opposite sides to permit the escape of the chips. The boy can feel the increased resistance to pushing when the flat drill begins to

FIGS. 2, 3 AND 4. HOLLOW MILL, DRILL AND DIE.

cut, and thus knows when he has pushed it on far enough.

The next tool used was the twist drill shown in Fig. 3, which projected from its holder just the proper amount to drill a hole of the correct depth. After this the die shown in Fig. 4 was run on to cut the thread. This was an ordinary adjustable round die, set in a 3-16 inch sheet brass disk with rounded edges, the adjusting screw heads being let in flush with the edge of the disk, and everything being made as smooth as possible, as the die-holder slips around in the boy's hand when it reaches the shoulder. The lathe was then stopped, but not reversed. The boy backs the die off a small fraction of a turn, and as soon as it is clear of the shoulder, he gives it a spin with his fingers, when it waltzes off in fine style.

The two tools shown in Figs. 5 and 6 are ordinary commercial belt punches,

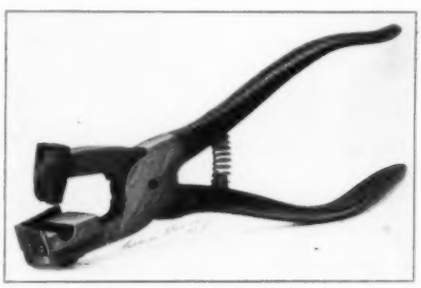


FIG. 5. FORMING TOOL.

with the punching parts removed, while a forming tool is screwed fast to the upper jaw of Fig. 5, and a cutting-off tool is held in the upper jaw of Fig. 6 with a set-screw. Both lower jaws have rests for the revolving rod, containing a half-round groove, and an end plate to properly locate the tools lengthwise of the rod. Fig. 5 is applied to the revolving rod until the forming tool strikes the rest, when it can go no farther. After cutting off the turned, bored and threaded piece with Fig. 6, the operation is repeated until all the rod that projects from the chuck is used up, when a fresh length is run out and treated likewise.

The slight tit left by the cutting-off tool is ground off by holding it against a wooden face-plate with emery paper glued on.

When necessary to sharpen the forming tool of Fig. 5, it is ground on its flat face and then packed out with paper or thin sheet metal to bring this cutting face central with the half-round groove in its rest.

The small hole is finally drilled by holding a No. 78 twist drill in the lathe chuck and drilling thru from the inside, holding the tips in the fingers. The finish was by buffing and plating.

The methods of manufacture here described look as tho they might be open to a certain amount of criticism in regard to the accuracy of the work produced, but the results obtained are fully up to the requirements of squirting cologne on a lace handkerchief.

R. A. STENDICKE.

The Manufacture of Celluloid and the Cause of Trouble With it

Editor American Machinist:

Replying to R. Griswold's inquiry, at

FIG. 6. CUTTING-OFF TOOL.

page 1000, respecting the queer behavior of celluloid triangles, etc., I can give some information on this subject, having had six years' intimate connection with the celluloid industry as mechanical engineer.

The base of celluloid and allied products is pyroxyline, soluble gun cotton, such as collodion is made from, or soluble paper made from pure cotton rags, this latter being mostly used.

The paper comes to the factories in large rolls, and is shredded or torn into small pieces or split into suitable strips. It is then heated to rid it of moisture before nitration takes place, the act of nitrating making the paper soluble.

The nitrating bath in which it is immersed for a given period is composed of nitric and sulfuric acids in definite pro-

portions, and it is right here that trouble often arises in this manufacture and it demands great care in order to produce good stock.

This nitrated paper, after being sufficiently immersed, is removed from the acid bath and placed in a centrifugal, which rids it of a large part of the adhering acid. It is then placed in a large water tank and washed thoroughly until tests show no trace of acid remaining. Thorough washing is imperative, or the stock is bad. The paper is then beaten to a pulp in a paper-beating engine and again washed and bleached in order that it may be perfectly white. By centrifugals it is then rid of most of the water, after which it is broken and rubbed into a moist pulp, which is thoroughly dried, when it is then ready for the solvent. Triangles and edges of T-squares are made from clear stock, containing no pigment; it consists of pyroxyline, the solvent and the coloring matter.

I have shown how pyroxyline is made. The solvent of the pyroxyline is spirits of camphor, grain alcohol being used. Wood spirit cannot be used, on account of its disagreeable odor. The camphor must be of good quality, sublimed (powdered), and the coloring matter something which will not fade on exposure to light, as anilines do.

Into a suitable airtight box, lined throughout with zinc, is placed a given weight of pyroxyline and sublimed camphor. This is thoroughly mixed dry, then sprayed with a given quantity of alcohol in which the coloring matter has been dissolved. Mixing with paddles goes on while spraying, after which the airtight cover hermetically seals the batch for digestion.

When thoroughly digested it is taken to rolls (such as used in rubber factories), where heat and cold can be applied, and there kneaded into a stiff dough. The process here separates, and I shall speak only of that part of it which relates to the making of sheets from which angles and T-square edges are made.

The dough is rolled to a thickness of ¾ inch and cut into rectangular slabs, 22x54 inches. These slabs are then placed in a strong rectangular frame or mold in sufficient quantity to form a block, say, 22x54x5 inches. The material is subjected to heat top and bottom, which will cause it, on pressure being applied, to weld into one solid block. The heat is then shut off, pressure still maintained, and a cooling agent, as cold water, circulated about it to set it. It is then taken from the press, adhering to an iron plate placed in the bottom of the mold for this purpose, which securely holds it while being cut into sheets, 22″x54″x any thickness wanted. These sheets are then taken to dry-houses and hung up to season, or, in other words, to expel as much of the volatile solvent as possible, after which they are straightened and ready to be cut up into triangles and a thousand other novelties.

I have described this part of the manufacture so that your readers may thoroughly understand the cause of the behavior as outlined by Mr. Griswold.

Acid stock from which the acid has not been thoroughly eliminated will give off acid fumes, and, being confined in a case, these fumes attack everything oxidable exposed; they may be almost imperceptible and yet very active. These fumes may condense on the surface and cause the moisture spoken of.

Acid stock becomes very brittle, and when in thin sheets or pieces will fly in pieces. I have seen it returned on several occasions on this account. The spots spoken of are due to acid attacking the coloring matter.

Respecting the button-shaped piece which chipped out of the center of a curve; this is due to imperfect welding of the slabs when making the block from which the sheets were sliced.

The T-square edges shrinking is largely due to unseasoned stock, and yet not all. Remember the volatile spirits of camphor is always passing off, and consequently the stock is always shrinking, especially in clear stock having no pigment in its composition; hence this freak and wood splitting, the celluloid having the biggest pull. No process, to my knowledge, has yet been found whereby this stuff will "stay put"; hence its unreliability; it will shrink more or less, depending on the care of its manufacture. The more pigment used the less shrinkage. Clear stock having no pigment shrinks most; there is no stop to it.

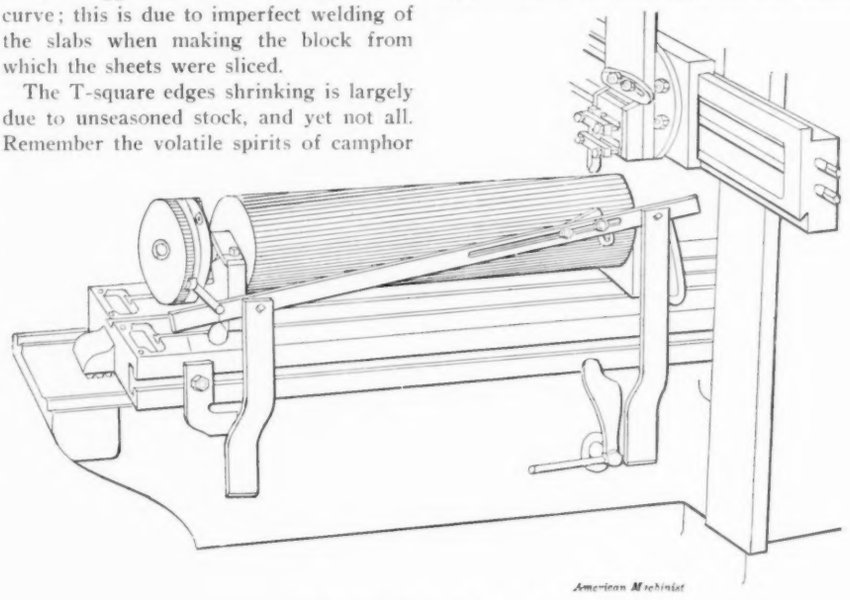
I myself use hard rubber (vulcanite), and prefer it. The transparent edge of pyroxyline compounds gives a reflected light perplexing to the eye. VETERAN.

Cutting Spiral Grooves On the Planer.

Editor American Machinist:

The article at page 968, by Paul Wesley, recalls a similar job which called out the device illustrated. Our rolls were 6 inches in diameter, 160 teeth to turn 20 teeth in their length. We mounted the roll in heavy crotches, and put a three-jaw universal chuck on the end of the journal. In the recess for the chuck plate we bolted the ratchet plate having 160 teeth. The lever ran on the inclined bar as in Mr. Wesley's device, but as it came back down the incline it would run the ratchet over twenty teeth and start a fresh tooth. For eight teeth it would run itself, but then it began over again and had to be set ahead a tooth when it would cut eight more. This appealed to my lazy bone and I bolted on the little extra incline at *A*. Then, by running the planer a trifle longer stroke, I could make the ratchet turn the roll a total of, say, 21 or 23 teeth, while it still turned only 20 teeth during the cut. By setting it to cut any number which did not have a common divisor with the number of teeth to be cut, it would cut all the teeth without attention. The addition of a flap of leather wired to the back of the tool to lift it off the work on the return made a complete outfit for the rough job required. Of course our spiral was, as you noted, not a true spiral or helix, but as it was for some kind of a flour or feed mill we doubt if the grain knew the difference.

E. H. FISH.



ROLL GROOVING MACHINE.

Working Drawing for Die for Armature Disks.

Editor American Machinist:

At your request, in response to the inquiry of your correspondent, I send you sketches of a compound die for armature disks designed to be used in a press with or without a positive knockout attached to it. The difficulty usually with a die of this kind is to make it "strip," or, as it is usually called, "shed" the blank. As the disk we here have to blank has some 20 inches of cutting edge, it will take 300 pounds pressure to shed it from the dies, and as 40 pounds pressure is the most we can get from a ½-inch spring of No. 34 wire, we must have ten springs. In the upper die, to insure its working properly, the die is recessed to take in a shedder

3¼ inches diameter that will hold these springs without crowding.

The lower stripper has only one-half this work to do, and so six of the springs *H* will do the work all right. This stripper is made in two parts, *C* and *N*, the ring *N* being cut in two. The twelve pins *O O* are screwed into it by means of a screw-driver slot in the upper end, not shown. The reason for its being made in this way is, that the space between the points *A A* is too small to support the part that strips the scrap from the holes, and so the pins *O O* act as a stripper. The split ring *N* is held in place by being screwed into the rest of the stripper *C*.

FIG. 1. THE DISK.

The die *A* is made of tool steel and can be used soft, or, what is better, can be hardened in cyanide and oil. Heat to a dull red, put in the cyanide and let it soak in, then dip in oil; if carefully done there is no danger from cracking.

The die is subpressed with four pins *E E*, made of 1¼-inch tool steel turned to 1 1-64, except at the lower end, which is left the full size for ¼ inch. These are hardened and ground to a nice sliding fit and are put in place in the die the last thing, in this manner:

Enter the punch into the die, and clamp it down to the drill table, using a pair of parallels to hold the upper and lower castings, *G* and *F*, the proper distance apart, then drill and ream the four holes and counterbore for the head of the pin. These pins act as a subpress and add to the life of the die and also do away with the necessity of putting in any "hold-back" screws into the strippers. In setting the die, slide it into the press and enter it enough to cut cleanly; you cannot "shave" it. The twelve small punches *K K* are held in the punch-back *P*, which is of tool steel, left soft. The reason for this is, if a punch breaks, you can do a better job of repairing when you can get at it than if it is driven into the casting *G*.

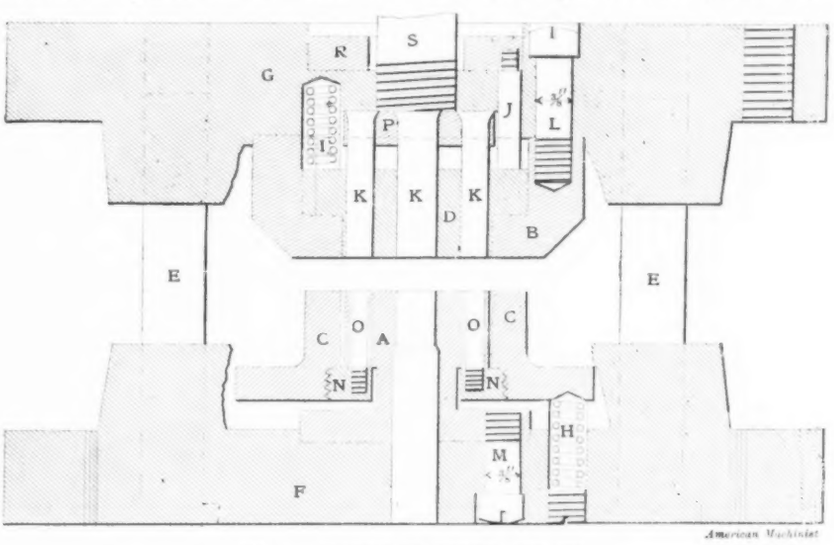


FIG. 2. SECTION OF PUNCH AND DIE.

The knockout plate *R* is to be used in connection with a positive knockout if there is one on the press. It is connected with the shedder by means of three pins, one of which, *J*, is shown in the sketch. The threaded hole *S* is for a shank to be used to attach the punch to the ram of the press. In machining up the die, rough it out on the lathe and then catch it in the chuck on the universal milling machine, and drill the twelve holes, then mill the twelve slots at the same setting, and then do the knockout *D* in the same way. Both the upper and lower die should be recessed into the castings, as shown in the sketch, and fitted to the same by grinding after being hardened.

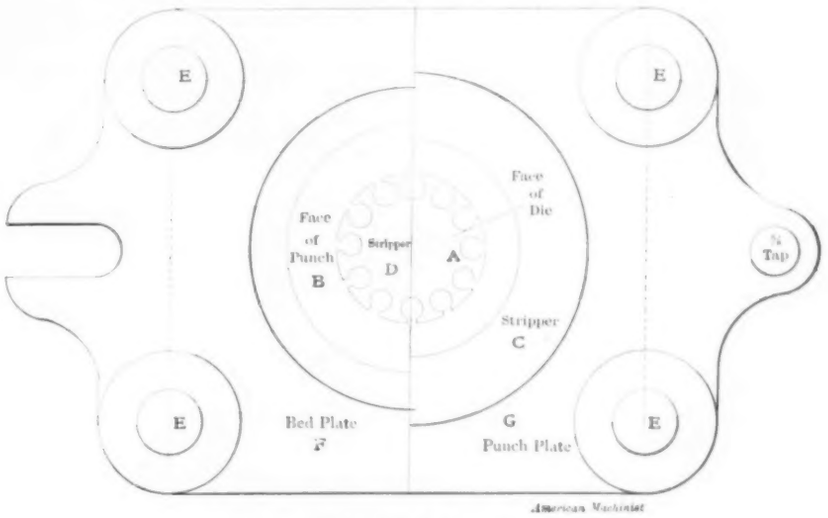


FIG. 3. PLAN OF THE DIE AND PUNCH.

The shop cost of the die should not exceed $100, and it should run off 10,000 to 20,000 blanks a day, according to the kind of stock used. If our correspondent will kindly keep an account of the cost of the die and let us know what it really did cost, he will confer a favor on us all.

The number of parts necessary are as follows: One die, *A;* one punch, *B;* one stripper, *C;* one shedder, *D;* four pins, *E;* one casting, *F;* one casting, *G;* five springs, *H;* ten springs, *I;* three knockout pins, *J;* thirteen punches, *K;* four ⅜ screws, *L;* four ⅜ screws *M;* one stripper ring, *N;* twelve stripper pins, *O;* one punch-holder, *P;* one knockout plate, *R*.

In sending you this copy, I think it is a case without a parallel—that is, a mechanical paper having a special tool designed and published at the request of a correspondent, who may or may not be a subscriber, the cost of said article being much more than the cost of a year's subscription of the paper. A. P. PRESS.

[As to the last named point, we should explain that we could not do this for one reader only. We do it because we believe the article will be of value to many others besides the one who asked for the design. —Ed.]

How to Harden a Drill for Drilling Tempered Tool Steel.

Editor American Machinist:

When it is necessary to drill a hole in tempered tool steel I first make a flat drill out of Stubbs drill rod. Then take a block of lead and drive the point of the drill into it for about one-quarter of an inch; then heat the drill in a charcoal fire

to a light cherry heat, insert it in the hole in the lead and allow it to cool. With slow speed and turpentine as a lubricator, a drill tempered in this way will do good work in tempered tool steel.

A. E. ABETZ.

Grinding Backed-Off Cutters.

Editor American Machinist:

A reliable method of sharpening backed-off cutters which have become radially distorted during the hardening process will probably be of considerable interest to your readers.

FIG. 1

FIG. 2

To insure the teeth of a distorted cutter all cutting equally, it is necessary, as in Fig. 1, to bring the cutter in contact with a revolving wheel in such a manner as to permit each tooth to be marked on its outside edge, and then, as in Fig. 2, to grind from the cutting face of each tooth sufficient material to cause the wheel marks just to disappear.

A cutter ground in this manner will work satisfactorily, but when dull requires extremely careful re-sharpening, and as the teeth probably are all of different thickness, the ordinary method of sharpening—by means of an index plate on the cutter arbor or by bringing a finger up against the back of each tooth in turn—will proove unsatisfactory.

It is of course possible by means of elaborate measuring to grind the cutters by hand; this being, however, an extremely risky and expensive experiment.

The jig shown in Fig. 3 and built by Ludw. Loewe & Co., Berlin, enables the cutters to be ground quickly and correctly independent of the skill of the grinder.

The cutter to be ground is mounted on an arbor and supported between the centers; the arms carrying the centers are longitudinally adjustable, and are mounted on the rail *a*, which is attached to the knee of the grinding machine.

Besides the arms carrying the centers, the piece *b* is mounted on the rail and provided with a T-slot in which is inserted the arbor *c*, which, as will be seen from the drawing, is vertically adjustable.

The sleeve *d* carrying the finger *e* is longitudinally adjustable and made an easy fit on the arbor *c*. It is held firmly in position by means of the two screws *f* and *g* and ring *h*. A vertically adjustable index appliance is mounted on the holder *i* and set to the diameter of the cutter in question. As the teeth of cutters regulated according to the method already described—*i. e.*, that of bringing their outside diameter in contact with a revolving wheel—will probably have different thicknesses, when regrinding the cutter must be mounted as already noted between the centers, the grinding wheel face having been previously alined to the center line of the arbor. Then by means of the adjusting screw *f* finger *e* is moved back far enough so that the cutter may be set to permit the necessary amount to be ground away for re-sharpening, and while in this position the stop *k* on the index pointer *l* is brought up against the back of the tooth and fixed by means of the screw *m*; the finger *e* is now withdrawn.

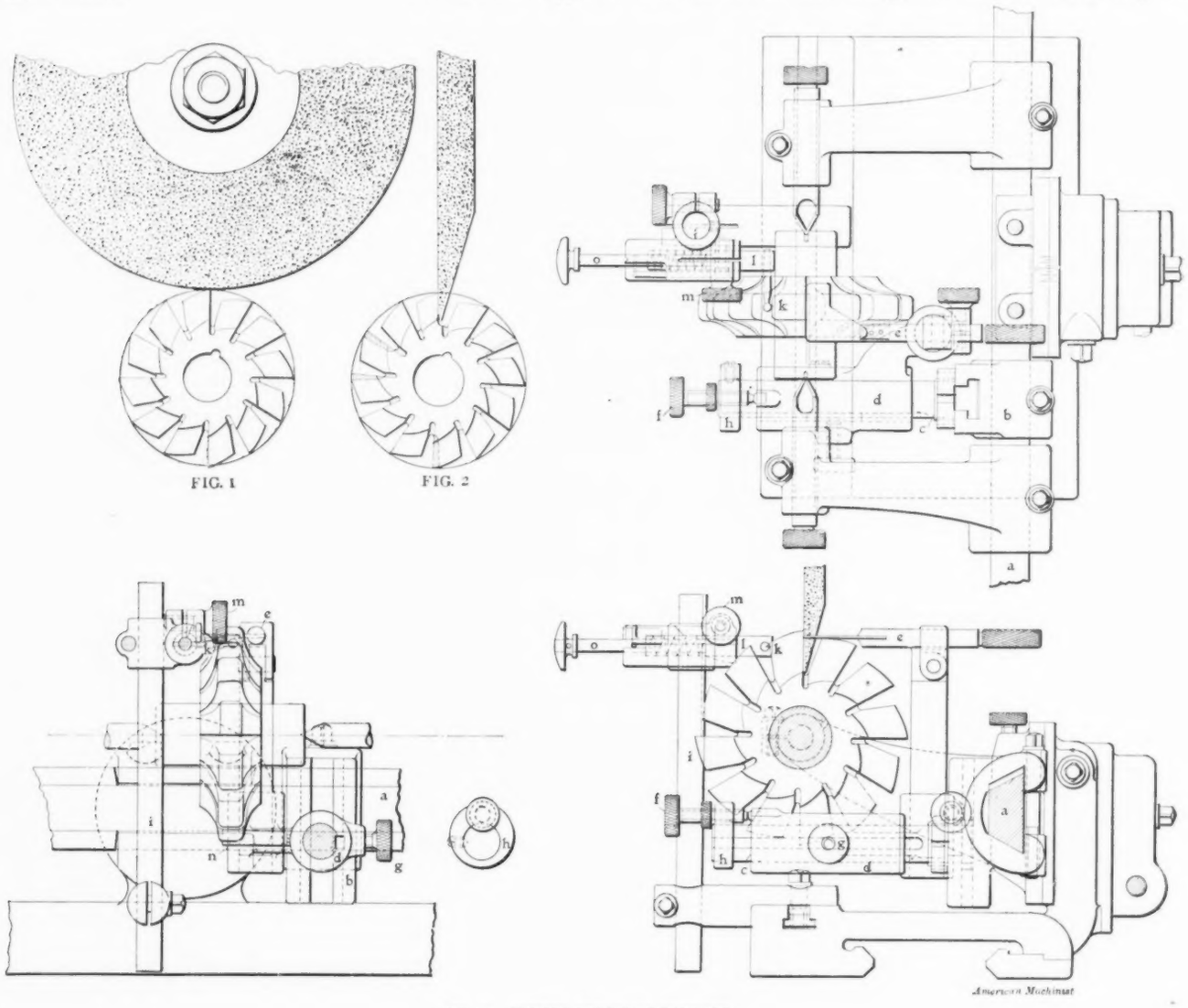


FIG. 3. CUTTER GRINDING FIXTURE.

In order to insure that the cutter shall press against the stop *k*, a spring *n* is attached to sleeve *d* and the pressure of this spring acts on a tooth diametrically opposite the tooth being sharpened. The tooth is then sharpened by bringing it in contact with the emery wheel until the

predetermined amount is ground away. The stop *k* is now removed by slackening the screw *m* and withdrawing the plug *o*. The adjacent tooth is now brought into position and the grinding operation continued.

THEOBALD MULLER.

Berlin.

Balancing Pulleys.

Editor American Machinist:

We all know of the old way of balancing pulleys, using the ways of a lathe for the mandrel to roll on and a piece of putty stuck on the light place, *then* weighing the putty and having the blacksmith get out a piece of iron the same weight and finally riveting it on. Here is the layout now used by the Whitcomb Manufacturing Company, Worcester, Mass.:

Fig. 1 gives two views of the weight used. For light pulleys they use three different sized weights, the surface *A* of the patterns being made the same circle as the inside rim of the pulley on which they are to be used. For instance, there is a pattern for each size of the 10-inch pulley weights, also for the 12- and 14-inch.

Fig. 2 is a box kept in a convenient place

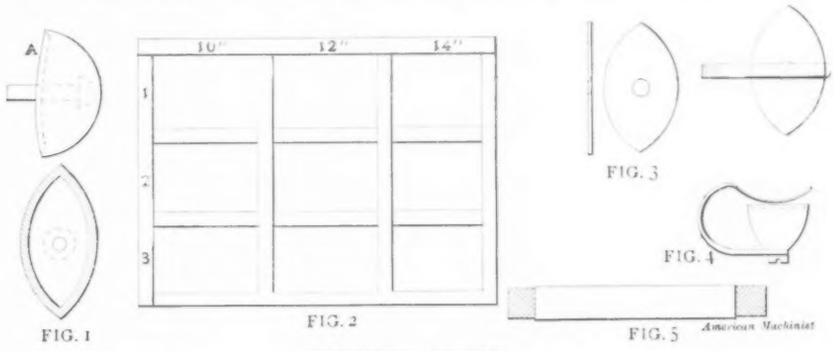


FIG. 1 FIG. 2 FIG. 3 FIG. 4 FIG. 5

BALANCING PULLEYS.

the first row of pockets in which holds weights of the three sizes for 10-inch pulleys, the second row for 12-inch, and so on. The box contains as many rows of pockets as there are sizes of pulleys to be balanced.

Fig. 3 is a piece of sheet lead punched out the same form as the weight at the point of contact with the pulley.

Fig. 4 is a test weight, which weighs the same as its corresponding balancing weight. The balancing way, which is of modern design, is kept near the box of weights. An anvil with a horn is also at hand.

When a batch of pulleys, say from ten to fifty, are ready to be balanced, an experienced man takes the arbor, Fig. 5 (which is hardened and ground), and puts one of the test weights (Fig. 4) on the tight side of the pulley. After finding the test weight which comes nearest to balancing the pulley, he slips one of the pieces of sheet lead between the weight and rim; if that is not enough, he puts in another; if a little too much, he just trims the end off the lead piece, and so on until the exact weight is found. Then with a piece of chalk he marks on the pulley 1, 2 or 3, indicating which weight was used, then 1, 2 or 3, the number of pieces of lead; for instance, a pulley requiring No. 2 weight and 2 pieces of lead would be chalked 2—2, or 2—2½, or 2—1¼, etc. After the pulley is tested and marked, a boy takes it and drills a hole to receive the rivet on which the weight is cast, and the man proceeds to test another. After all are tested and drilled, the man and boy rivet on the weights and the operation is completed.

The company has made no records yet on balancing pulleys, but it is safe to say that if a man could do one pulley in a given time in the old way he could do ten with this up-to-date method. C. M. C.

Mexican Industrial Development.

The development in all industrial lines now proceeding in Mexico, as compared with five years ago, is surprising. American, German and British manufacturers and exporters are the principal competitors in this market, with other countries to a lesser degree. Contracts are being made for apparatus for the transmission of power for factories, for irrigation, for electrical purposes, machinery for sugar mills, cotton mills, agricultural implements, structural iron and steel, etc., and on every hand, in town and country, one is confronted by the evidence of the solid and substantial progress of the republic.

The demand for mining and reduction machinery, as well as for electrical machinery and appliances, has doubled itself within the last two years. The expansion of the great railroad systems, now aggregating 10,000 miles, has brought about the rapid development of new industries, which in turn have created a large and growing demand for every kind of machinery.

In one year the exports of agricultural implements to Mexico from the United States alone amounted to a total value of $330,910, and during the same time the value of the shipments of cars, passenger and freight reached a combined value of $1,153,577; during the same period iron and steel, billets, plates, builders' materials, etc., amounted to a value of $2,837,708; while the exports of machinery such as cash registers, steam, fire and locomotive engines, etc., amounted to $6,939,955; and of nails, pipes and fittings, safes, stoves, and all other manufactures the total value was $3,636,523.

The commercial possibilities which present themselves in Mexico can hardly be adequately understood by one not on the ground or who has not made a study of the industrial situation. Mexico is just beginning to feel the benefit of good government, and to respond to the magic touch of modern science, energy, and capital.

The field for development in electrical lines alone is enormous. In a country like Mexico, where the cost of fuel cuts deeply into the profits of the manufacturer, the demand for electrical power is growing rapidly. Every town and village of any pretensions is clamoring for the introduction of electricity, and the powerful waterfalls which abound in every State of the Republic are being harnessed for the purpose.

Mexico needs money for investment, machinery to develop her mines, railroads to open up the rich tropical and timbered areas which spread out in every direction.

German and British manufacturers, as well as those in the United States, are vieing with each other in pushing sales of machinery for sugar, coffee, textiles, electricity, mines and milling equipment of every description. It is admitted, however, that we have very strong opposition to face along these lines, and from the countries named, as being the most important of our competitors, and to our usual push in the introduction of our goods in any new field it will be necessary, if we expect to retain the foothold, which foregoing figures show that we have so well established, that we should add excellence of material, and with this combination there is little doubt but that we can hold these now rapidly increasing markets against all comers.

A. F. TENNILLE.

Those who attended the Detroit meeting of the Manufacturers' Association and witnessed the strenuous opposition there "put up" by the knit goods manufacturers to any proposition looking to a loosening of the restrictions upon international trade either by reciprocity treaties or in any other way will probably be surprised to read in a recent consular report sent in by our consul at Chemnitz, Germany, an account of the mistakes made by American manufacturers of such goods who supply German importers. Among these mistakes there is no mention of their charging too high prices to enable them to compete with the German article, but there is a lot of others—carelessness in attending to correspondence, giving figures of weight and cost in unfamiliar terms, etc.

"But you can't make a machine that will think."

"No," replied the inventor, "and I wouldn't if I could—if I thought it would think as some people do."—*Chicago Record-Herald.*

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Stealing Men.

It is related of a certain pioneer American "ironmaster" that when he was preparing to go into the business of rolling iron he went to England, carefully inquired for the name of the best roll turner in England, hired him and brought him over here. Was this a creditable or a discreditable thing to do? Each will answer for himself, but we hope none of our readers at least will base his answer upon the fact that this was a case of stealing a man from a foreigner instead of from a fellow-countryman. The day has gone by, we hope, when the equity of an act depends upon the nationality of the individual affected by the act. If it is wrong to steal (money or men) from one's fellow-countrymen, it is equally wrong to steal (money or men) from a foreigner. There are many employers who are extremely scrupulous about "stealing men" and very many more who are accustomed to let their angry passions rise when good men are "stolen" from them—especially by a competitor. But, after all, is there any really good foundation for the common sentiment on this subject? Does it not imply some things which are strenuously denied by those who do not countenance what they call "stealing"? When a church congregation finds itself pastorless—owing perhaps to the fact that its faithful pastor has been stolen by a wealthier congregation—it sends a committee to go and hear another preacher and if their verdict is favorable he "receives a call." There is in such cases no thought of stealing or of being stolen, or of being robbed; the general conclusion being that both ministers who have changed places have been put in fields of "greater usefulness." College professors often change places in much the same way, and so do superintendents of manufacturing establishments, editors and others. "Stealing" seems to be applied only to those who earn "wages" as distinguished from those who are paid "salaries," and there is some reason for believing that the sentiment against it is really a survival of times when "masters" came much nearer having some sort of proprietary rights in their "servants" than modern ideas will tolerate in free countries.

Many years ago "Chordal," discussing this question in our columns, said: "I have had men stolen from me, and called the stealer a thief. I have stolen men from other folks and have been called a thief. I have been stolen myself, and always had the most respect for the biggest thief. The way to get men is to pay their value, the way to hold them is to pay their value, and the man gets and holds his place by making himself valuable. . . . I claim that when one man goes to work for another for the time being he reserves the right to constantly exert himself to do better, and also the right to invite better offers right on the premises. The idea of presuming that paying a man for present services gives the right to blindfold him and stop up his ears forever!"

At the least it is quite clear that proprietary claims should be held to be reciprocal. That is to say, if the employer has a claim upon an employee of such a nature as to justify the term "stealing" in connection with the departure of the employee to take a better job, then it would seem to follow that the employee has an equally valid title to his job and has an equal right to speak of it as having been "stolen" from him when he is displaced by a man who is considered better fitted for it or who is willing to work cheaper. If there is any rule in these matters it obviously ought to work both ways.

Automobile Exports and Imports.

It is of course impossible to determine the total annual production of automobiles in either this or other countries, but it is quite possible for us to know the exports and imports of these vehicles, and *The Horseless Age* has collected some interesting figures. The business is rapidly growing and the values involved are becoming of national importance. It will doubtless come as a surprise to many that for every car of foreign manufacture imported into this country at least five cars of native construction are exported. The difference in total values is not as great as thus indicated, because the more expensive machines are imported, while our production, at least for export, is largely of a cheaper class.

Exports and imports of automobiles of noticeable amount both date from 1901, and the values of our exports in this line have since then continuously exceeded the imports, while the number of machines exported has been largely in excess. There has been, and there is still, a rapid increase of international trade in this line. The following are the numbers and the total values of automobiles imported for the successive periods:

	No.	Value.
Year ending June 30, 1901	25	$43,094
Year ending June 30, 1902	224	530,876
Year ending June 30, 1903	317	963,998
Nine months ending March 31, 1904	279	872,251

The importation of parts of machines increases these values something like 10 per cent. More than nine-tenths of the entire importation comes from France, England coming next, a long distance behind.

Our export trade in automobiles is very differently distributed, it practically covering the entire globe. The following is from the list of exports for the fiscal year 1902: Great Britain and Ireland, $671,553; France, $59,051; Canada, $31,111; Mexico, $27,710; Germany, $24,491; the Philippine Islands, $14,216; South Africa, $12,637; Austria, $13,106; Argentine Republic, $10,203; Cuba, $11,152; Belgium, $7,797; Denmark, $9,905; Holland, $5,285; British Columbia, $4,828; Peru, $3,000; China,

$6,645; Japan, $9,513; British East Indies, $4,299; Italy, $2,200; Brazil, $2,150; Australia, $0,851; Bermuda, $1,500; Hong Kong, $1,175; Norway and Sweden, $1,697.

In 1901 the total value of automobile exports was $367,371; in 1902, $1,069,872; in 1903, $1,643,029, and during the first five months of 1904, $789,218. The value of the cars exported in 1903 was therefore about 63 per cent. greater than that of the cars imported during the year. The average value of the exported cars will hardly have exceeded $1,000, so that 1,600 cars were shipped from this country, or about five times as many as were imported. About the same relation between exports and imports obtains still.

An Interesting Application of the Slide Rule.

When the readers of the AMERICAN MACHINIST begin the discussion of a subject that interests them it is generally pretty difficult to tell when the discussion has reached finality or what may be called its logical conclusion. It is to be feared that in many cases a goodly proportion of our readers get tired of and drop a subject before it is ended; we pursue it for the benefit of those who are really interested in it and who can make good use of the points brought out. We have published a good deal of matter on the subject of proportioning cone pulleys and systems of gearing for obtaining graduated variable speeds. If it were not for the fact that we have had a lot of experience calculated to make us very cautious in such cases, we should be tempted to say that Mr. Bruce has in this issue brought the question down to its simplest terms. At any rate we feel warranted in saying that no one who has, or may have problems of this sort to solve can afford to ignore this article. It describes one of the neatest, most useful and most labor-saving applications of the slide-rule that has ever come to our notice.

The B. F. Sturtevant Company is fitting up quarters in its plant to be used for an emergency hospital, in case of accident to employees. It is to be equipped with all the appliances known to medical and surgical science for the proper care of the men who may get injured in the discharge of their duties until they can be removed to their homes. A graduate nurse and medical student will be in charge and a local doctor will attend to all surgical cases.

The Machinery Hall Exhibitors' Association at St. Louis has elected the following officers: President, J. S. Holmes, of Buffalo; first vice-president, Col. F. F. Coleman; second vice-president, F. A. Gale; third vice-president, Capt. W. H. Greenland; secretary, H. D. Aller; treasurer, Leon Plaud.

Some New Things.

WOODEN RIM PULLEY WITH IRON HUB AND ARMS.

The Reeves Pulley Company, of Columbus, Ind., is placing a new pulley on the market. The center of the pulley is a gray-iron spider, the arms of which are

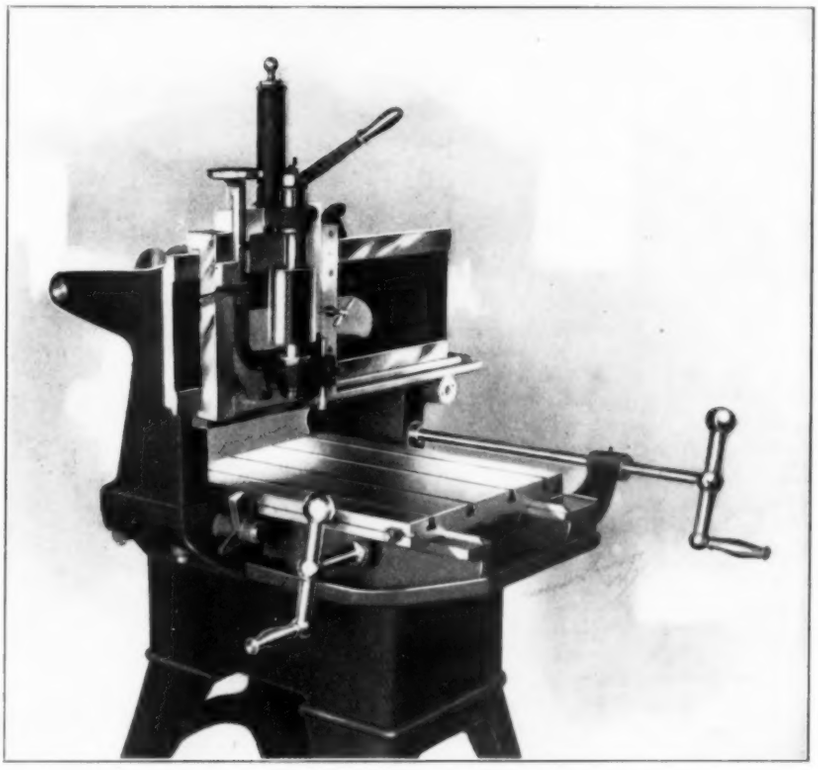
WOODEN PULLEY WITH IRON CENTER.

secured to the rim by means of an iron shoulder extending from each spoke, which is fastened by an iron pin driven thru the shoulder, and extending nearly across the face of the pulley, the fastening being entirely concealed. The rim is built of short segments of hard wood, nailed and glued. The finish is machinery black inside and orange shellac outside. This pulley is made in various sizes and styles, viz.: Split—all pulleys bored to a uniform size, 3½ inches, and equipped with interchangeable split iron bushings; split—bored to fit the shaft (see illustration); solid—bored to fit the shaft. The first two styles are held to the shaft by compression, and a key if desired; the last style by set-screw or key, or both. The pulleys with wide faces have two sets of spiders.

The pulley was designed primarily for textile mills, dynamos, and in fact any service demanding minimum air disturbance.

PROFILING MACHINE.

The machine shown is a special type of profiler adapted for working up light castings, such as cash register frames, etc., which have a number of ledges and bosses to be surfaced off to gage to receive other parts and to be interchangeable. The upright has a deep-ribbed section where the belt passes and rests on cored supports having a span of 27 inches; the table, which measures 22x27 inches, is provided with four T-slots for holding work. In milling off a number of vertical spots or surfaces to stand at gaged distances apart some provision must be made for locking the table or cross-slide in successive positions, and a special feature of the machine is the arrangement for doing this. For the table, a swing stop seen to the left and just in front of the upright is provided, and a T-slot in the edge of the table receives the stop blocks. The arm of the swing stop is thrown over against the edge of the table between two stop-blocks and either locks the table or permits a certain play between the blocks; or when set in the intermediate position it will strike the high block and pass over



PROFILING MACHINE.

the low one. The stop arm being swung out, the table is free to move to a new position. A similar device is provided for the cross-slide, so that both table and cross-slide can be locked in any position in their whole travel, and the straight spots standing in any relative position to each other can be located exactly. A micrometer stop with lock notches is provided for the spindle slide for gaging depth of cut and for taking cuts at different hights. For curved work a former is provided on the fixture holding the work, using the former pin on either side of the spindle, or a roller on the shank of the cutter itself can be used without any former pin. A large tank for soda water is cast in one piece with the bed. The makers are the Garvin Machine Company, New York.

60-INCH ROLL TURNING LATHE.

The accompanying illustrations show a 60-inch motor-driven roll turning lathe just built by the American Tool Works Company, of Cincinnati, Ohio. The lathe is

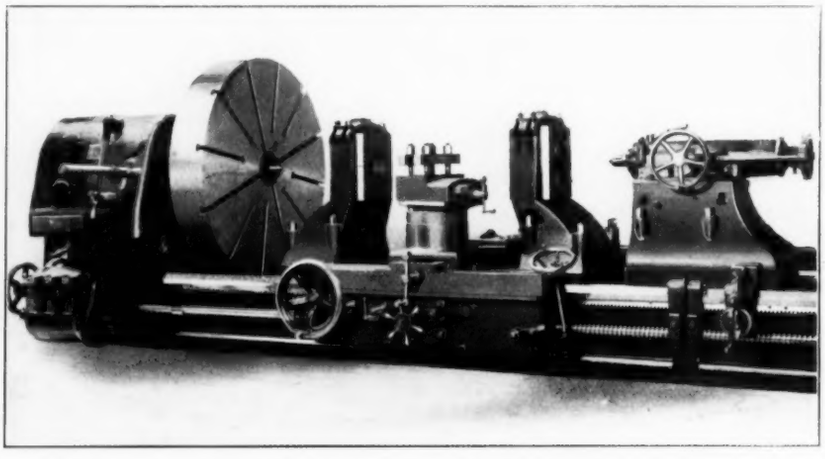


FIG. 1. 60-INCH ROLL TURNING LATHE.

driven by a 25 horse-power variable-speed motor which is mounted on a stand at the rear of the headstock and is connected to the driving shaft in the headstock by chain. Primary speed variation is obtained electrically thru manipulation of the hand-wheel at the right-hand end of the carriage, which starts, stops and reverses the machine and also varies the speed. These electrical changes are supplemented by mechanical changes obtained thru the all-gear headstock by means of the two levers shown on the front of the hood. The proper combination of the levers for any desired speed is indicated by index plates. The range of speeds thus obtained thru both the headstock and the motor is very wide. Below the headstock, on the head end of the bed, is located the geared feed changing device. Thru the three levers shown at the front of the box seven distinct feeds are obtainable without removing a gear. The gears are mounted on two shafts and are housed in. Simple index plates show the various combinations for obtaining any desired thread, pitch or feed. The housings shown are for the purpose of holding heavy pipe roll castings. At the rear of the machine, mounted on the rear of the bed, is shown a roll-forming attachment (see Fig. 2), the purpose of which is to impart curved surfaces to long pipe straightening rolls. A shoe, provided with anti-friction rollers, slides in a trough following master bars, thus generating the same curve on the rolls being turned. Straight work can be turned by disengaging the nut which holds the

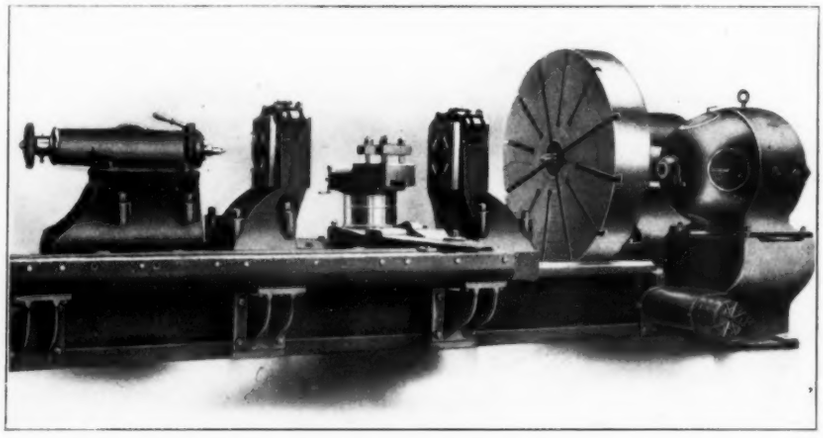


FIG. 2. REAR VIEW SHOWING ROLL FORMING DEVICE.

shoe and by tightening the cross-feed nut. A concaving rest is furnished which is interchangeable with the compound rest, and is used for grooving out pipe welding rolls, with capacity for rolls for pipe from 2 to 20 inches diameter; a limiting gage is provided for setting the tool to any desired diameter. This rest operates with rotary motion, thru worm and worm-wheel, with either hand or power feed.

A "UNIQUE" PATTERNMAKERS' LATHE.

For the adjective selected to characterize this lathe the builders, and not we, are responsible. The lathe, however, is of such interest as to warrant a more extended description than can usually be given to the new tools as they appear. Those who have been in the way of noting the details of our mechanical progress

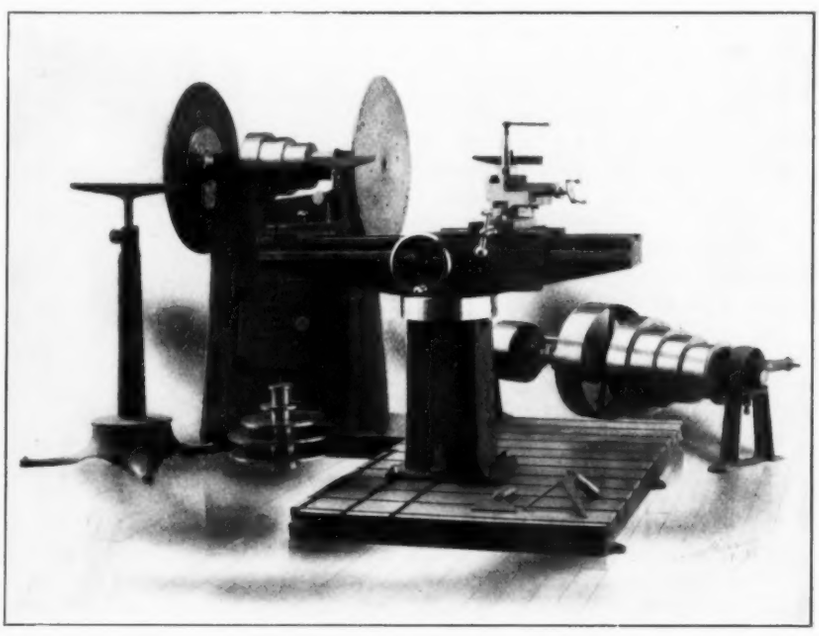


FIG. 1. "UNIQUE" PATTERNMAKERS' LATHE.

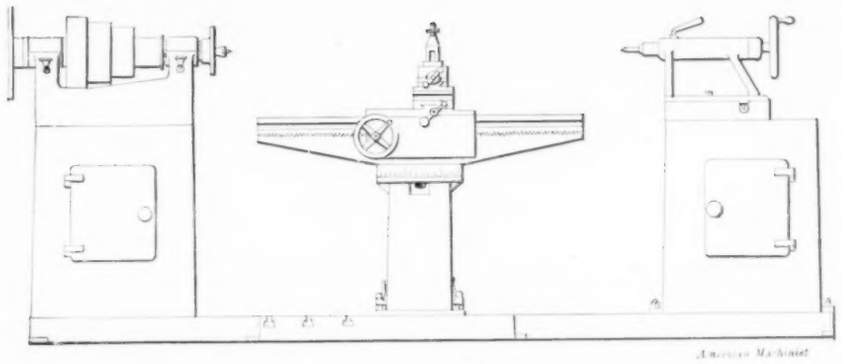


FIG. 2. "UNIQUE" PATTERNMAKERS' LATHE WITH TAILSTOCK.

have often wondered that the woodworkers, especially those who have to do accurate and responsible work, as is required of patternmakers, have been so long contented to go along with the primitive and mostly hand-operated tools, and have not availed themselves of the facilities for accuracy and for rapidity of production which the metal workers have so universally adopted. That they have not been so contented and acquiescent as would appear is evidenced by the appreciation and avidity with which the most advanced tools of the best patternmakers' tool builders are received, and this lathe needs only to be known to find extensive employment.

The lathe is shown in simple form in the half-tone, Fig. 1. It may properly be called a "universal" lathe, according to the use of the adjective in the machine trade. With its various modifications, it is adapted to ordinary turning, to work of large diameter, to long rolls or columns, to gearing whether spur or bevel or to all varieties of angular work. Both ends of the spindle are provided with face-plates of different sizes. The lathe will swing 92 inches over the floor and 88 inches over the sole-plate, and with a pit there is practically no limit to the swing. The headstock is made with or without back gearing, but is always furnished with the back gears for pit work. The spindle is hollow, machine ground and supported in heavy, adjustable, self-oiling bearings. Bronze thrust collars are provided and the cone is turned inside and out.

All the grooves in the sole-plate are planed accurately parallel with the spindle or at right angles to it and to the same width. The tool-carrying standard can be located and secured with its central tongue in any groove, and to move it from one groove to another it is never necessary to lift it off the plate, entailing, besides the labor of lifting it, the probability of getting dirt under it. The central tongue is lifted by a cam lever at each end of it, and then the standard can be slid around as desired, and when in position the tongue can be dropped into the groove, thus accurately locating it. The tool carriage swivels on the standard to any angle and is accurately graduated. The compound rest which carries the tools is also graduated and can be set at any angle desired.

Fig. 2 shows the lathe with tailstock for work to be turned on the centers. The additional piece of sole-plate for this may be made of any length desired.

In Fig. 3 are given three views, not all to the same scale, of the lathe with gear-cutting attachment for accurately spacing and cutting the teeth on spur or bevel-gear patterns.

The lathe here shown is in no respect a "cheap" tool, and the cheap is nowhere more out of place than in the machine tools of the patternmaker. It seems to have been the purpose of the builders to omit or to neglect nothing, either in design or manufacture, which could contribute to the accuracy or the efficiency of the tool. The lathe is built by the Oliver Machinery Company, Grand Rapids, Mich.

QUARTERING LEVEL FOR LOCOMOTIVE DRIVING WHEELS.

The illustration shows a quartering level for locomotive driving wheels. The object of this tool is to facilitate the quartering or setting at right angles to each other, the crank-pins of locomotive driving wheels. It consists of a skeleton frame *A* to which is attached another frame *B* which can be slid along *A* by means of a screw. The parts *C*, *D* and *E* are attach-

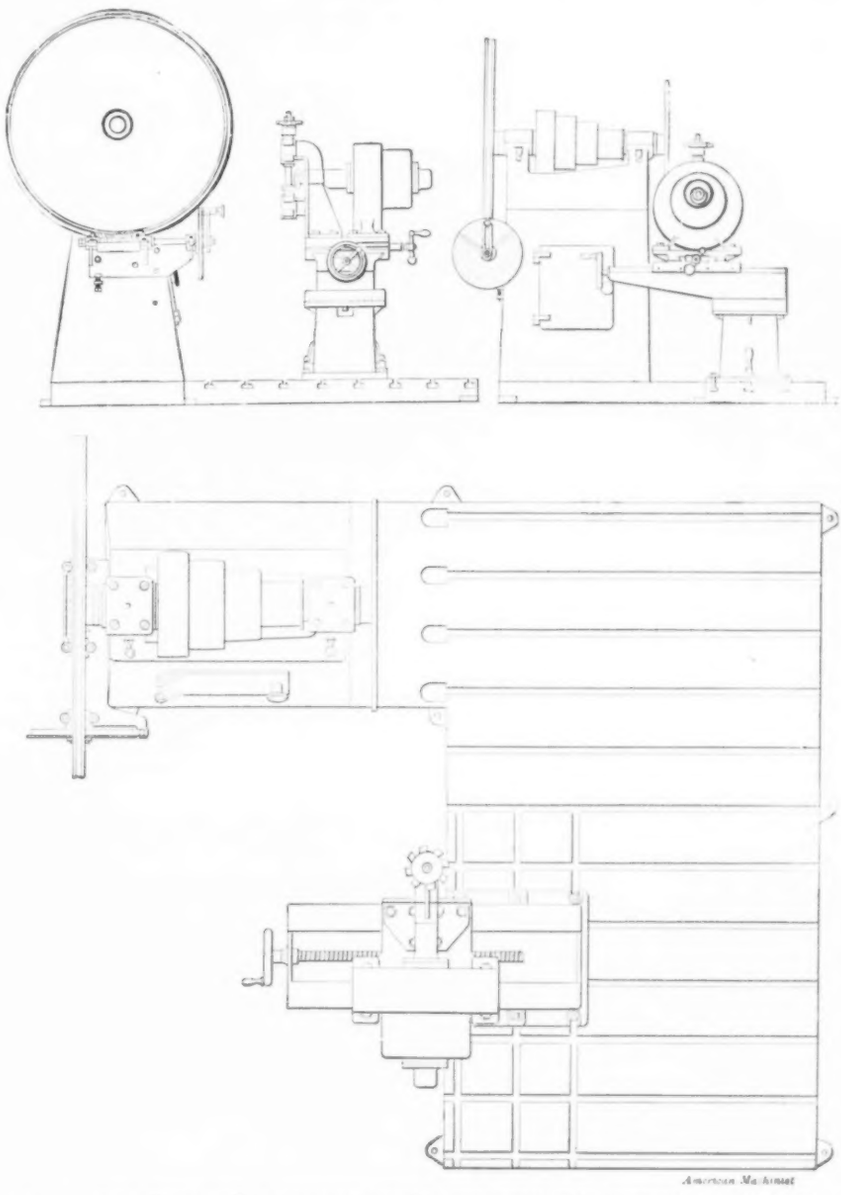
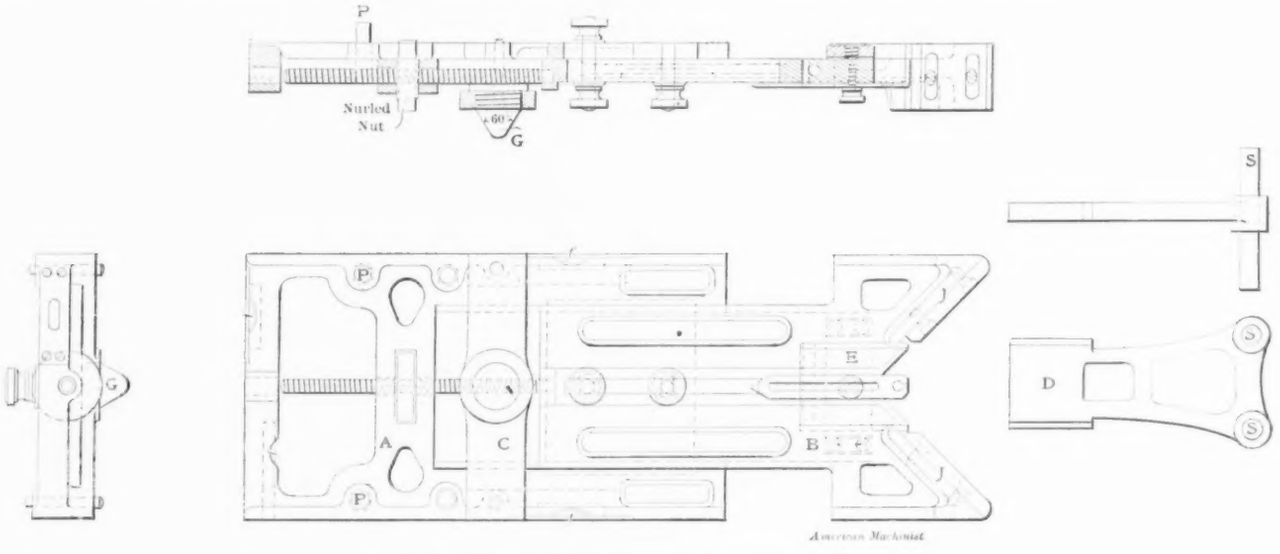


FIG. 3. THE "UNIQUE" PATTERNMAKERS' LATHE WITH GEAR CUTTING ATTACHMENT.

ments; their uses will be explained later. The nain body of the tool *A* has its sides at right angles to each other. Mounted upon these sides are the spirit levels *f, f, f, f*. The operation of setting a pair of driving wheels is as follows: The axle is set up on V-blocks at such a hight that the wheels will clear the ground. The wheels are then forced on part way. The pins *P* in the frame *A* are then entered in the bore of the driving wheel, and the pins *S* in the attachment *D* (which has previously been placed in position in the part *B* occupied in the illustration by attachment E) are entered in the crank-pin hole. The nurled nut on the adjusting screw is then turned in the direction to spread the parts *A* and *B*. This brings the pins *P* and *S* up against the opposite sides of the bores for the axle and the crank-pin respectively. The wheel is then turned on the shaft till the level shows that the holes are horizontal. The other driver is then treated in the same way till the other level (the one at right angles to the one first used) shows level. Attachment *C* has a center *G* to be used when the axle is in place in the driver. The "V" part *J* on *B* is for use up against the crank-pin, when it is in place in the driver. The attachment *E* is used for locating and scribing keyways. This tool was invented by W. A. Nunnally, 415 Thirty-third street, Richmond, Va.



QUARTERING LEVEL FOR LOCOMOTIVE DRIVING WHEELS.

Changes in the Beer Habit of German Workmen.

Frank H. Mason, United States Consul-General at Berlin, calls attention in *Consular Reports* to the fact that the production of beer in Germany in 1903 declined to 1,787,615,000 gallons, which was 132,085,230 gallons less than that of the United States for the same period. In explanation Mr. Mason says:

"The falling off in this country is attributed to several causes, among which were a cold, wet summer which did not provoke the usual consuming thirst, the spread of temperance reform principles among the middle classes, and, principally, the fact that during the prosperous industrial development of the past ten years the families of workingmen have become accustomed to more and better food, clothing, and general comfort, so that when hard times and shortened labor decrease the earnings of the bread winner, he is obliged to economize in his beer as well as in the meat bill and other expenses of the family. There are, moreover, several large factories and machine shops where the afternoon 'beer pause' has been abandoned, and where if any drink is served tea or coffee has been substituted."

Igorrote Chief Has a 'Phone.

After a close but surreptitious observation of the telephone in the office of the Igorrote administration on the Philippine Reservation at the World's Fair, at St. Louis, the other day, Antonio, the chief of the Bontoc Igorrotes, informed Governor Hunt that he desired to have a 'phone put in his hut.

Governor Hunt at first refused, and was calmly informed by the chief that if the Governor would not put the "talking box" in his hut, he would buy one for himself. It developed in the conversation that Chief Antonio believed that the nailing up of the box was all that was needed and that he could then use it to converse at once with anyone he pleased. He had not reckoned with "central" or outside fittings.

Governor Hunt, seeing that Antonio was determined to have the 'phone, ordered one for each of the chieftains, Antonio and Lumewess. When asked if he thought Antonio could learn to use the 'phone, Governor Hunt said: "He will know how to use it before it has been in the hut two hours."

Technical Publications.

A publication that is new to us is called *Freight; The Shippers' Forum.* As its subtitle indicates, it aims to stand for the rights of shippers of freight and of the public generally, and the issue we have seen contains a number of articles of special value to freight shippers. It is published by Freight Publishing Company, 116 Nassau street, New York.

"Kinks and Recipes for Engineers." Edited and arranged by Warren O. Rogers and Geo. A. Seaton. 196 4½x6-inch pages, with 176 illustrations. The Engineer's Review Company, Cleveland, Ohio.

This little book is an engineer's manual of expedients and devices for temporary repairs and to facilitate engine-room work. A large number of emergency cases are related and simple expedients for meeting them are described.

"Hilfsbuch für den Maschinenbau. Für Maschinenteckniker sowie für den Unterricht an technischen Lehranstalten." By Prof. Fr. Freytag, Instructor at the Public Technical Institute in Chemnitz, Germany. Pp. 1008, 5x8 inches; 867 illustrations and 6 tables. Berlin: Julius Springer.

The task performed by Professor Freytag in the preparation of this work has been no slight one. He has produced an engineering hand-book chiefly specialized to the field of machine design, yet with a volume and comprehensiveness of matter which we think is equaled by few, if any, similar works. After covering the design of machine elements and details the volume is filled with chapters on cranes, steam and gas engines, steam and water turbines and other subjects. Water motors, excluding water wheels, are treated by Engineer Gerlach of the institute at Chemnitz; Professor Wagner, of the same, contrib-

utes a chapter on buildings, and at the end is a brief summary of patent laws.

"The Softening and Purification of Feed Waters for Boilers." By J. C. W. Greth. 26 6x9-inch pages. Reprinted from the Proceedings of the Engineers' Society of Western Pennsylvania. Wm. B. Scaife & Sons Co., Pittsburg.

The paper, of which this pamphlet is a reprint, describes the water purifying apparatus made by the Scaife Company, and in addition it gives a clear and intelligible account of the problem of water purification, including the chemistry of the process and comparisons of the cost of different reagents. The pamphlet is published for gratuitous distribution and contains a good deal of information in small compass.

It is announced that the coming spring meeting of the American Society of Mechanical Engineers will probably be held in Scranton, Pa.

Personal.

Will the person who signs himself "A. Yap" send his name and address to the editor?

Theodore H. Miller, superintendent of the De Laval Cream Separator Works at Poughkeepsie, N. Y., was married August 10 to Mary Florence MacDonald, of Poughkeepsie.

Obituary.

John F. Starr, president of the First National Bank, Camden, N. J., died August 8, eighty-six years old. Mr. Starr was born a Quaker and at the age of fifteen went to learn the trade in his father's boiler works. In 1840 he became associated with his father and brother in business. In 1846 he built the Camden Iron Works, and later with his brother he built new and larger works on the present site. He retired from the firm in 1870.

Alexander Gartshore, a prominent Canadian iron founder, died at Hamilton, Ontario, July 13, sixty-five years old. Mr. Gartshore began working in his father's foundry at Dundas in 1858, and in 1865 was admitted to partnership. In 1870 he moved to Hamilton and formed a partnership in the making of railroad and other castings, the business being the first to engage in the iron pipe industry in Canada. In 1857 Mr. Gartshore designed the first pumping engine for the Hamilton water works.

Arthur Tim, general foreman of the Juniata Locomotive Works of the Pennsylvania Railroad, Altoona, Pa., died August 2, forty-four years old. Mr. Tim was born in Pittsfield, Mass., where he served his apprenticeship as a machinist. He became foreman of the Carlisle (Pa.) Machine Works and later of the machine department of the Huntington (Pa.) car shops. When the Juniata Locomotive Works were being built he took charge as foreman of the machine shop and later was made general foreman, which position he held until his death. Mr. Tim was well versed in modern shop methods, and introduced many improvements which increased production and reduced costs.

Business Items.

The Cincinnati Machine Tool Company has completed the removal to its new plant at Spring Grove avenue and Township street, Cincinnati, Ohio. The buildings have been particularly designed and constructed for their business and equipped with every facility possible for the building of upright drills.

The S. W. Card Manufacturing Company, of Mansfield, Mass., has opened an office at 123 Liberty street, New York, where it has placed one of the largest as well as most complete stocks of taps, dies, screw plates, etc., ever carried in New York city. Mr. A. H. Briggs, manager of the New York office of the L. S. Starrett Co., will also represent it in this capacity. All orders placed at this address will receive prompt and careful attention and it trusts to be able to make immediate delivery of all regular catalog goods.

Dodge & Day, engineers, Philadelphia, have completed their plans and specifications for extension to the plant of the Victor Talking Machine Company. They contemplate the use of 600 horse-power horizontal tubular boilers, four units, each 18 feet long by 72 inches in diameter, with a working pressure of 125 pounds; natural draft; two horizontal automatic high-speed engines, 160 and 240 horse-power respectively, direct connected to a 100-kilowatt and a 150-kilowatt generator; fifteen electric motors, ranging from 5 to 75 horse-power; two elevators; heating system; fire, feed water and vacuum pumps; switchboard and wiring, sprinkler system, water tanks, etc.

Manufacturers.

A new typograph factory is to be erected in Windsor, Ont.

The Grand Rapids Foundry Company has increased its capital stock.

The plant at Victoria, B. C., of the Albion Iron Works has been damaged by fire.

The plant of the Watertown (N. Y.) Electric Light Company will be improved.

H. Reynard & Co., of Taylor, Pa., are, we understand, to build a silk mill in Scranton.

The Vitrified Wheel Company, Westfield, Mass., has occupied its new factory building.

The Canadian Government thinks of spending $80,000 on a dredging plant in Vancouver.

The Auburn (N. Y.) Hame Company is to erect an 80x300-foot, two-story factory building.

A rolling mill is considering whether it will come to Dunkirk, N. Y. It employs 200 men.

It is understood that the Petersburg (Ind.) Galvanized Iron Works will move to Terre Haute.

It is proposed to erect an additional building for the Earnscliffe Worsted Mill, Olneyville, R. I.

Repair shops of the American Refrigerator Transit Company, at St. Louis, Mo., have been burned.

A mill at Spokane, Wash., leased by the Portland (Ore.) Flouring Mills Company, has been burned.

J. L. Echols and associates are contemplating erecting a $15,000 electric light plant for Decatur, Ala.

An addition will be built to the plant of the Universal Caster & Foundry Company, Newark, N. J.

The plant of John T. Lewis & Bros. Company, white and red lead, Philadelphia, Pa., is to be enlarged.

The contract has been let for the concrete work in the Butler Engineering Company's plant, at Butler, Pa.

The contract has been let for additions to the Pennsylvania railroad machine and repair shops at Pitcairn, Pa.

A packing plant is proposed at Fort Scott, Kan. Parties interested have met in the office of J. I. Sheppard.

The Warner Electric Company, or the Warner Gear Company, Muncie, Ind., will make extensive enlargements.

A permit has been granted for a large extension to the factory of the Verity Plough Company, Brantford, Ont.

It is stated at Washington, Pa., that the Gardner Convertible Steam & Gas Engine Company will erect a plant.

A plant has been started in Cortland, N. Y., to make flour from skimmed milk. The industry thrives in Germany.

Quite a disastrous explosion has occurred at the plant at Versailles, Pa., of the Railway Signal Company, of Pittsburg.

John T. Abney, of Laurens, S. C., proposes to build a new cotton mill at Columbus, Ga., of about 20,000 spindle capacity.

Kellam & Shaffer, Schenectady, N. Y., have bought a new site for their stone-cutting plant and will install more machinery.

Refrigerating machinery will probably be installed within a year by the East Tennessee Brewing Company, of Knoxville.

Citizens of St. Charles, Ill., are considering a proposition which may place there the Draggett Trolley Company's factory.

The United States Court has ordered the sale of the plant of the Harlan & Hollingsworth Company, in Wilmington, Del.

The Western Tool Works are getting their plant at Galesburg, Ill., into shape and are already at work on their automobiles.

Contracts have been awarded by the Mesta Machine Company, Pittsburg, Pa., for the extension of its plant in West Homestead.

P. A. Peterson and others at Rockford, Ill., are offering a 10-acre site there to a large Chicago furniture manufacturing concern.

The large new addition of Landers, Frary & Clark, cutlery and hardware, New Britain, Conn., will probably be ready by January 1.

The Champlain Silk Mills, of Whitehall, N. Y., are planning to raise the dam three feet, which will provide for an increased output.

The Northwestern Barb Wire Company, of Sterling, Ill., has been inquiring for a building in Burlington, Ia., to which it might move.

The Business Men's Association of Annapolis, Md., is trying to get a branch plant of the Amherst Knitting Company, of Philadelphia.

The local management of the Berwick (Pa.) plant of the American Car & Foundry Company, of St. Louis, Mo., is said to be urging its enlargement.

The Tupelo (Miss.) Cotton Mills directors have voted to increase the captal stock $40,000, for the purpose of increasing the capacity of the plant.

It is stated at Franklin, La., that the Teche Transportation Company has leased land fronting on Bayou Teche and will erect a modern shipyard.

The Brady Cement Stone Machine Company, Jackson, Mich., is erecting a 40x80-foot factory building. Next year it expects to build a foundry.

The Norton Emery Wheel Company, Worcester, Mass., has bought 1¼ acres of land and it is said that plans are on foot for additions to the works.

The Merrell Manufacturing Company, maker of pipe threading and cutting machines, of Toledo, O., has increased its capital stock from $50,000 to $80,000.

John Threadgill, who has bought at auction sale the Oklahoma Woolen Mills property at Oklahoma City, O. T., is planning to transform it into a cotton factory.

William Hilton, Ralph Hilton, George R. Mitchell *et al.*, of Newburgh, N. Y., have organized a company and will erect a plant to manufacture sand-lime brick.

The Crunden-Martin Woodenware Company, St. Louis, Mo., proposes greatly to increase its facilities. The plans include the erection of a bagging factory.

The Washington Cedar Lumber Company, Ballard, Wash., thinks of erecting a big mill in connection with extensive timber property purchased in British Columbia.

The Enterprise Manufacturing Company, hardware, etc., Philadelphia, has received a permit to build an addition to its plant on Bodine street, south of Dauphin.

Charles and Van Farquarson and W. Bowen, of Niles, O., have formed the Valley Plate & Sheet Iron Works, to make sheet barrels, etc., and have ordered machinery.

A lead pipe and smelter works of St. Louis, Mo., may locate in Marion, Ind. The Commercial Club has authorized Secretary W. H. Wiley to accept the proposition made.

City Architect Charles F. Hermann, Chicago, Ill., has made plans for the sewage pumping station which the city will build at Jackson avenue and Seventy-ninth street.

The Delaware Suburban Railway Company will build a line from Wilmington, Del., to Elkton, Md. A power plant will be erected at Newark, Del. B. F. Myers is president.

The Acme Wire Company, Cuyahoga Falls, O., has been incorporated with a capitalization of $150,000. It will take over the holdings of the Cuyahoga Wire & Fence Company.

At Spokane, Wash., the safe-making business is to be started by the M. H. Reynolds Steel Safe & Manufacturing Company. M. H. Reynolds and A. C. Edwards are the prime movers.

The Windsor Pump & Foundry Company, a new industry in Windsor, Ont., has received its provincial charter. Geo. B. McCleod is president. Plant will be located in an existing building.

Edward O'Brien and John Hinkle have started a brass foundry at Front and Reaney streets, Chester, Pa. It is the intention to make a specialty of castings for wood-working machinery.

It is reported that a concern designated as the Cable-Nelson Piano Company, of Chicago, will move its big plant to South Haven, Mich., under an agreement with the local board of trade.

The Business Men's Association, Davenport, Ia., is considering a large beet sugar factory proposition made by M. H. Miller, representing a Bay City, Mich., industry, said to be a Havemeyer interest.

The Orange, N. J., Common Council has received a communication from the Harley Process & Enameling Company asking what advantages would be offered if it decided to locate its plant there.

The Oleson Manufacturing Company expects to build a small factory on Clark street, Toledo, O., to make the Oleson air brake. Mr. Oleson, Karl Mathias and F. W. Showell are concerned in the matter.

A New Orleans chemist is investigating the properties of the "water hyacinth," which grows almost everywhere in that region. It is of a fibrous nature and might perhaps be made useful for textiles.

A large drydock at McLellanville, a part or suburb of New Orleans, La., which was never completely put together, is to be put in commission for the McLellan Dock Company, work having already started.

The Allen Portland Cement Company, lately chartered, has plans prepared for a mill to be built next spring at Nazareth, Pa. It is understood to be controlled by large German manufacturing interests.

It is possible that Wheeling, W. Va., may have a concern to take up the manufacture of metal skiffs and light river craft. The building of the first boat is in fact under way at the plant of Charles H. Miller.

A four-story building at Milwaukee, Wis., containing the plants of the Riverside Printing Company, Milwaukee Blankbook Manufacturing Company and Northwestern Lithographing Company, has been burned.

The Atlantic Coast Line Railroad has purchased the Jacksonville & Southwestern Railroad, and will operate the same. The latter recently built shops at Jacksonville, Fla., which will, it is reported, be enlarged.

A building permit for a $3,000 mining machinery shop at Fourteenth and Blake streets, in East Denver, Colo., has been taken out. W. O. and L. A. Reynolds and A. L. Englebach arranged for the lease of the site.

It is stated at Marion, Ind., that Walter Beer, of Beer Brothers, well-known oil supply merchants (address not given), is looking for a location on which to start a shop for automobile engines. Muncie, Ind., has been dickering with the firm.

George B. Linney, banker, of Osceola, Mo., and Bert Chase, of Freeport, Ill., have been organizing a company for the manufacture of burglar-proof vaults. It is expected that the factory will be located in Freeport and a building has been secured there.

A Western concern wishes to build an Eastern plant—an iron foundry and annexes for its line of goods—and inquiry has been made at Chester, Pa., for about 15 acres of land at tidewater. Hubert J. Riley, president of the Board of Trade, is in touch with the matter.

The General Railway Signal Company, which was incorporated under New Jersey laws, with $5,000,000 capital, for the purpose of merging the Pneumatic Signal Company, of Rochester, N. Y., and the Taylor Signal Company, of Buffalo, has elected officers.

A permit has been granted to demolish an old building on Buttonworth street, between Seventeenth and Eighteenth streets, Philadelphia. The property is owned by the Baldwin Locomotive Works, which will in the near future erect on it an addition to their plant.

The Fort Wayne (Ind.) Electric Light & Power Company is merged with the Ft. Wayne & Southwestern interurban traction company. The Ft. Wayne & Wabash Valley Traction Syndicate will, it is said, later control these companies, and a joint power station to cost a million dollars be built in Ft. Wayne.

Grand Rapids and other Western cities have been visited by B. Forsinger, of Albany, N. Y.; Rudolph Duffy, of Philadelphia, and Andrew Peck and Willis Barth, of New York city, with a view to locating an automobile plant. They are interested in a plant in New York and desire to establish a branch.

D. G. Devenish, treasurer of the Asheville (N. C.) Cotton Mills, and other men have incorporated the Elk Mountain Cotton Mill Company (capital $150,000). They will install machinery in the old Whittam cotton mill at Asheville, using electrical power from a water power company's plant, and may later build a mill to make their own yarns.

Preliminary work has been started for the erection of a plant at Connellsville, Pa., by the Munson Heater Company, capitalized at $40,000, which will manufacture a patent hot air heater, the invention of Capt. George A. Munson, of Connellsville. The first plant built will be in a building 120x32. Within a year this will be much enlarged.

There is a possibility that a new factory for the manufacture of plows and spreading machines will be located in Brantford, Ont. The men behind the scheme are Americans, and their representative, Mr. Johnson, has been inspecting sites. The manufacturers' committee of the aldermen (Ald. Pickles, chairman) is understood to have further information, but it is not yet made public.

Word has been received that the plant at Gadsen, Ala., of the Central Foundry Company, New York city, is to be placed in operation, after three years' idleness, and will employ about 500 men. Mayor Robt. Campbell, of Gadsen, being offered the management of the company's works at Bessemer at a large salary, is said to have conditioned his acceptance upon the reopening the plant at his own town.

It is stated at Mexico City that General Gaspar Sanchez Ochoa, the owner of the sulfur mining claims in the crater of Mt. Popocatepetl, has been negotiating their sale to a New York syndicate, of which Captain Charles Holt, of New York city, is one of the organization committee. He is, or lately was, in Mexico. One of the things which Captain Holt is working on is a plan of a 7,000-ton-per-hour (?) loading plant for the sulfur product at Veracruz. It is stated that the Allis-Chalmers Company will send a man to make estimates.

The plant of the Stilwell-Bierce & Smith-Vaile Company, in Dayton, O., has been appraised, with a view to being sold as an entirety in bankruptcy proceedings now in the United States Courts. J. H. Gardener, William Lodge and A. H. Kamper examined the property in detail and fixed its value, as a going concern, with the good will of the present company, at $1,265,870. The part known as the "old plant" is estimated to be worth $252,778; the "new plant," $300,000; stock on hand, $450,000, and the machinery, $123,091. The trustees now in charge of the property have recommended a sale of the plant as an entirety.

New Catalogs.

Baltimore Gas Machinery Company, Baltimore, Md. Descriptive catalog of Baltimore suction gas producers. 4x9, pp. 12, paper.

Reeves Pulley Company, Columbus, Ind. Reeves wood split pulleys, design, construction and application, described and illustrated. 5¼x7¾, pp. 31, paper.

Golding Manufacturing Company, Boston, Mass. Illustrated catalog and price list of cabinets, stands, racks and cases made by this company. 6x9, pp. 17, paper.

Walker Grinder Company, Worcester, Mass. Walker new universal toolroom grinders, grinder parts and accessories. Illustrated by photographs and drawings. 6x9, pp. 15, paper.

The Hoggson & Pettis Manufacturing Company, New Haven, Conn. Illustrated catalog of Sweetland chucks, standard and special; chuck jaws, drill press vises, etc. 4¾x7, pp. 54, paper.

Williams Brothers Company, Philadelphia, Pa. Hoisting engines for all purposes, winch engines, steam cranes, steering engines, ship steering gear, etc. Illustrated. 6x9, pp. 115, paper.

Star Corundum Wheel Company, Detroit, Mich. Catalog and price list of "Star" emery and corundum wheels.

Grinding Machinery Company, 23 South Canal street, Chicago, Ill. Grinding machinery and emery wheels. Catalog "A," illustrated. 6x9, pp. 128, paper.

Chas. G. Allen Company, Barre, Mass. The Diamond tapping attachment and the Diamond self-opening die, recently put on the market by this company, are shown in two illustrated booklets. 3½x6, paper.

The Bullock Electric Manufacturing Company, Cincinnati, Ohio. Bulletin No. 1026, describing and illustrating design and application of type "H" and "HI" Bullock multipolar motors and generators. 6x9, pp. 20, paper.

National-Acme Manufacturing Company, Cleveland, Ohio. "The Spirit of Progress" is the title of an attractive catalog illustrative and descriptive of the "National-Acme" automatic screw machine and its products. 7x8¾, pp. 8, paper.

National Electric Company, Milwaukee, Wis. Stationary and portable motor-driven air compressors for continuous and intermittent service, described in detail and illustrated by fine half-tone cuts. Bulletin No. 350. 6x9, pp. 10, paper.

Ames Iron Works, Oswego, N. Y. Catalog describing and illustrating the various sizes and types of engines and boilers built by this company, including engines of the throttling type, automatic type, high speed and direct-connected. 6x9, pp. 45, paper.

Grafton L. McGill, 15 William street, New York. "Relation of Employer and Employee in Reference to Inventions," a paper read by Mr. McGill before the Modern Science Club of Brooklyn, N. Y. This paper is reprinted in pamphlet form, and a copy will be sent to anyone interested upon request.

Chicago Pneumatic Tool Company, Chicago, Ill. Catalog of belt-driven and motor-driven air compressors built at the Franklin works of this company. The different sizes and types of compressors shown are illustrated and described in detail, and the catalog contains much useful information on air compressors generally. 6x9, pp. 72, paper.

R. D. Cole Manufacturing Company, Newnan, Ga. We have received a handsome catalog or souvenir commemorative of the fiftieth anniversary of the founding of this business. It gives a history of the inception and growth of the industry, and contains excellent portraits of the founders and present executive staff of the firm. 9¾x12½, pp. 32, paper.

Baldwin Locomotive Works, Philadelphia, Pa. Record of Recent Construction, No. 7, St. Louis Exposition number, illustrates the progress made in locomotive building by this company since its inception, and shows a number of engines demonstrating the graded advancement in size and style from the first to the most modern Baldwin locomotives. 6x9, pp. 73, paper.

The Hartford Machine Screw Company, Hartford, Conn. 1904 machinery catalog, illustrating and describing in detail the design and construction of the automatic screw machines, pin and stud machines, forming machines, bench milling machines and other automatic machinery built by this company. The catalog is printed on coated paper and the illustrations are from photographs. 6x9, pp. 113, paper.

Miscellaneous Wants.

Advertisements will be inserted under this head at 25 cents a line each insertion. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

Caliper cat. free. E. G. Smith, Columbia, Pa.

Punches & dies. Wal.M.Wks.,Waltham,Mass.

Will buy or pay royalty for good patented machine or tool. Box 282, AMER. MACH.

Light mach'y to order; model work; rubber molds. J. W. Weir, Bridgeport, Conn.

Light and fine mach'y to order; models and elec. work specialty. E. O. Chase, Newark, N. J.

Special machinery to order. Geo. M. Mayer, M. E., 1131 Monadnock, Chicago, Ill.

Automatic machinery designed and constructed by the Wellman Sole Cutting Machine Co., Medford, Mass.

Wanted—To make a patented article or machine on royalty or other suitable terms. Address "Cor," care AMERICAN MACHINIST.

Auto. machinery of all kinds designed and built; hardened and ground work, flat or circular. Wiebking, Hardinge & Co., Chicago.

A director of methods for increasing machine shop output solicits engagements; vast experience; excellent record. Box 196, A. M.

Will purchase, or manufacture on royalty, patented machine of merit. Address, with full particulars, Box 176, AMER. MACHINIST.

Wanted—Second-hand triple geared engine lathe, about 72 in. swing, 9 ft. between centers; state make and price. Box 239, AM. M.

Addressing machines without type; high speed; run by motor or foot power; write for the picture book. B. F. Joline & Co., 123 Liberty st., New York.

Wanted—By fully equipped and modern machine shop, special machinery or machine parts to build by contract or day work. Address Ingle Machine Co., Rochester, N. Y.

Mechanical engineer and shop man would like to interest responsible manufacturing concern in a well-designed line of triplex pumps (operated by electricity or other source of power), with a view of manufacturing same. Address Box 242, AMER. MACH.

Wanted—Correspondence with firms considering manufacturing or extending their business in England, by an energetic American, thoroughly experienced in modern shop practise and machinery designing; married; good references. Box 240, AMER. MACHINIST.

For Sale.

Complete set of drawings for small gas engines; write for information. Box 247, A. M.

Canada.—Double-blade hacksaw; cuts in half time; Canadian patent for sale; particulars. F. B. Wright, 177 Broadway, New York.

For Sale—1 Farrell Foundry hydraulic pump and press; 800 tons; cost $1,950; will sell very reasonable; perfect condition. H. M. Crowell Mfg. Co., 6th ave. and 13th st., Newark, N. J.

Wants.

Situation and Help Advertisements only inserted under this head. Rate 25 cents a line for each insertion. About six words make a line. No advertisements under two lines accepted, and no advertisements abbreviated. The cash and copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded. Applicants may specify names to which their replies are not to be forwarded; but replies will not be returned. If not forwarded they will be destroyed without notice. Original letters of recommendation or other papers of value should not be enclosed to unknown correspondents. Only bona-fide situation want or help want advertisements inserted under this heading. Agency advertisements must be placed under Miscellaneous Wants.

Situations Wanted.

Classification indicates present address of advertiser, nothing else.

ILLINOIS.

Automatic machinery draftsman, 3 years' experience, wishes position; Eastern States preferred. Box 245, AMERICAN MACHINIST.

Draftsman, mechanical engineer, with large experience in mining machinery, special hoisting engines, wants position; anywhere. A. M., 936 Monadnock Bldg., Chicago.

Engineering salesman, technical graduate, desires position; experienced in Corliss engines, pumps, air compressors, boilers, elevating and conveying machinery. Address Box 230, AMERICAN MACHINIST.

MASSACHUSETTS.

Mechanical engineer, with extensive shop experience, desires permanent, responsible position which requires technical training as well as practical knowledge; salary not less than $1,300. Box 262, AMERICAN MACHINIST.

Mechanical draftsman and practical machinist, designer of automatic and special machinery, tools, jigs, fixtures, etc., desires position as superintendent, assistant superintendent or general foreman; present employment chief draftsman. Box 232, AM. M.

NEW JERSEY.

General draftsman and mechanical engineer wants position. Box 208, AM. MACH.

Designer and draftsman, with 4 years' experience in engines and special machinery, desires position. Box 268, AMER. MACH.

Designer and draftsman of special and automatic machinery, jigs, fixtures, etc.; 14 years' practical shop and drawing-room experience; any State. Box 241, AMERICAN MACHINIST.

NEW YORK.

Experienced draftsman, graduated, electrical line preferred. Box 260, AMER. MACH.

An experienced machinery and electric crane salesman wants position for New York territory. Address Box 257, AMER. MACH.

Young mechanical engineer, 26, with shop and drawing-room experience, wishes position; salary wanted $80. Box 256, AM. M.

Foundry superintendent is open to correspondence; engine and machinery; good references. Address Box 261, AMER. MACHINIST.

Draftsman, technical education, with 3 years' drawing and 5 years' shop experience, wants position. Box 263, AMER. MACHINIST.

First-class tool and die maker, good on drawing, forming and cutting dies; also all-around general machinist; age 41. Box 267, AMERICAN MACHINIST.

Foreman, expert tool and die maker, exceptional ability handling men and systematizing work, at liberty September 1. Box 248, AMERICAN MACHINIST.

Mechanic, wide experience, technical education, speaks four languages, wishes position; salesman or demonstrator. Box 254, AMERICAN MACHINIST.

Position by first-class machinist; 14 years' experience erecting steam engines, on the road and in the shop; good references. Box 264, AMERICAN MACHINIST.

Machine tool salesman, well known to trade in New York and New Jersey, wants position; have had long practical and business experience and can get results. Address Box 265, AMERICAN MACHINIST.

Mechanical draftsman and designer, 25, technical graduate from Germany, 11 years' experience in shop and drafting room, wants to change; gas engine manufacturing preferred. Box 246, AMERICAN MACHINIST.

Position as superintendent or general foreman, by a thoroughly up-to-date mechanic, 37, with 20 years' experience on machine tools, interchangeable machinery and automobile manufacture. Box 220, AM. M.

Fourteen years' experience, covering machine tools, rolling mills, special machinery and electrical machinery, as engineer, designer and superintendent; member A. S. M. E.; open for engagement. Box 259, A. M.

Mechanical engineer will be open for engagement in September as superintendent or master mechanic; technical education and large experience in the manufacture of small interchangeable machinery, sheet metal goods, etc. Address Box 244, AMER. MACHINIST.

Do you want an experienced and systematic superintendent or manager with an extensive practical and business experience on medium and light machinery, one having a defined policy and capable of carrying it out for profit and smooth running? If so, address Box 266, AMERICAN MACHINIST.

OHIO.

Experienced machinist; Gisholt operator; state wages paid; non-union. Box 251, A. M.

Position as assistant superintendent or designer desired by graduated M. E.; organizer; competent, reliable, able to handle men; experiences general, special automatic machines, machine tools; A1 references. Box 255, AMERICAN MACHINIST.

PENNSYLVANIA.

Mechanical draftsman, 4 years in shop, 3 years at the board, wishes position. Box 252, AMERICAN MACHINIST.

Automatic screw machine hand desires position in or near New York city. Address Box 253, AMERICAN MACHINIST.

Position as foreman or assistant superintendent; technical education; practical experience, up-to-date draftsman; executive ability; west of Pittsburg preferred. Box 243, AMERICAN MACHINIST.

A practical machinist, with technical education, at present engaged, desires change; 35 years of age; 15 years' experience; the past 8 years as manager, buyer and chief designer of manufacturing plant building en-

gines, boilers, sawmill machinery, etc.; salary $2,500. Address E. H., care AM. MACH.

Help Wanted.

Classification indicates present address of advertiser, nothing else.

CANADA.

Wanted—First-class engineer and draftsman; technical graduate preferred; one with experience in water-wheel, pulp and sawmill work; state age and experience. Box 205, AMERICAN MACHINIST.

ILLINOIS.

Wanted—In Chicago, first-class toolmakers for sub-press dies and general tools. Address Box 237, AMERICAN MACHINIST.

Wanted—A contracting engineer, familiar with coal-handling machinery and plants; headquarters in the Middle West; permanent employment for the right man. Address, giving age, experience, references and salary wanted, Box 215, AMERICAN MACHINIST.

MICHIGAN.

Wanted—A recent graduate as assistant in a technical school mechanical engineering laboratory and drawing room. Box 153, A. M.

NEW JERSEY.

Wanted—At once, mechanical, detail draftsman on electrical work; one with experience in tool work preferred. Box 238, AM. M.

NEW YORK.

Superintendent for machine shop. Address, stating references and salary expected, A. B. C., care AMERICAN MACHINIST.

Designing draftsman, experienced on steam pumps and engines; state age, nationality, experience and wages expected. Box 250, AMERICAN MACHINIST.

Two good draftsmen on work similar to light structural iron and wood work; must have had at least 2 years' drafting experience; state age, salary expected and references. Box 218, AMERICAN MACHINIST.

Wanted—Hustling foreman for machine shop in large electrical factory in Canada, particularly on induction motors and direct-current work. Apply, giving refereces, experience and wages required, Box 189, A. M.

Wanted—Thorough mechanic as foreman; must be capable, energetic, progressive and reliable; one familiar with special machinery, machine tools and jobbing preferred; give full particulars, stating age, experience, wages, references, etc. Address Box 258, AMERICAN MACHINIST.

OHIO.

Wanted—First-class machinist who has executive ability; able to take charge of 12 to 15 men in medium and light class of work; a good position to the right man. Address, with reference, Box 249, AM. MACH.

PENNSYLVANIA.

Wanted—A first-class draftsman. Address Box 217, AMERICAN MACHINIST.

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Flat Turret Lathe Jigs.

EDITORIAL CORRESPONDENCE.

In the accompanying engravings are shown a few of the jigs and fixtures used in the manufacture of the Jones & Lamson flat turret lathe. The two sizes, namely 2x24 and 3x36 inch, are produced by precisely similar methods; the majority of the drawings here reproduced, however, represent tools for the smaller, or 2x24 inch, cross-feeding head, and several views of the latter are given therefore in Fig. 1.

The head is planed at the top to receive the long caps (one of which is shown in the drawing) and at the bottom to fit the crossways on the bed. The caps already planed and then drilled for dowel pins and holding-down bolts by means of simple jigs clamped to their top surfaces, are clamped in position on the main head casting and used as jigs for correctly locating the corresponding holes in that casting. After these holes have been drilled and tapped, and the gib screw holes put in thru simple plate jigs, the caps are secured by screws and dowel pins and the boring fixture in Fig. 2 is called into service.

This fixture is provided with ways like those on the bed, and the head when slid into position as indicated by the finely dotted lines, has precisely the same bearing as when fitted to the bed, it being drawn up against the important surface *a* and clamped by its own gibs so that the

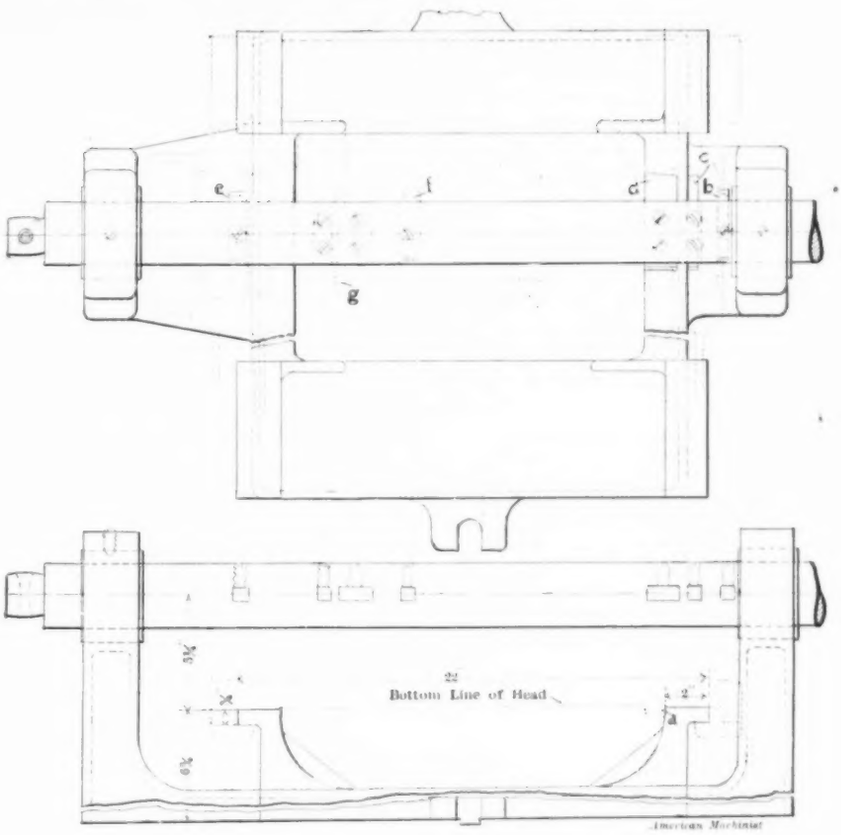


FIG. 2. FIXTURE FOR BORING SPINDLE BEARINGS.

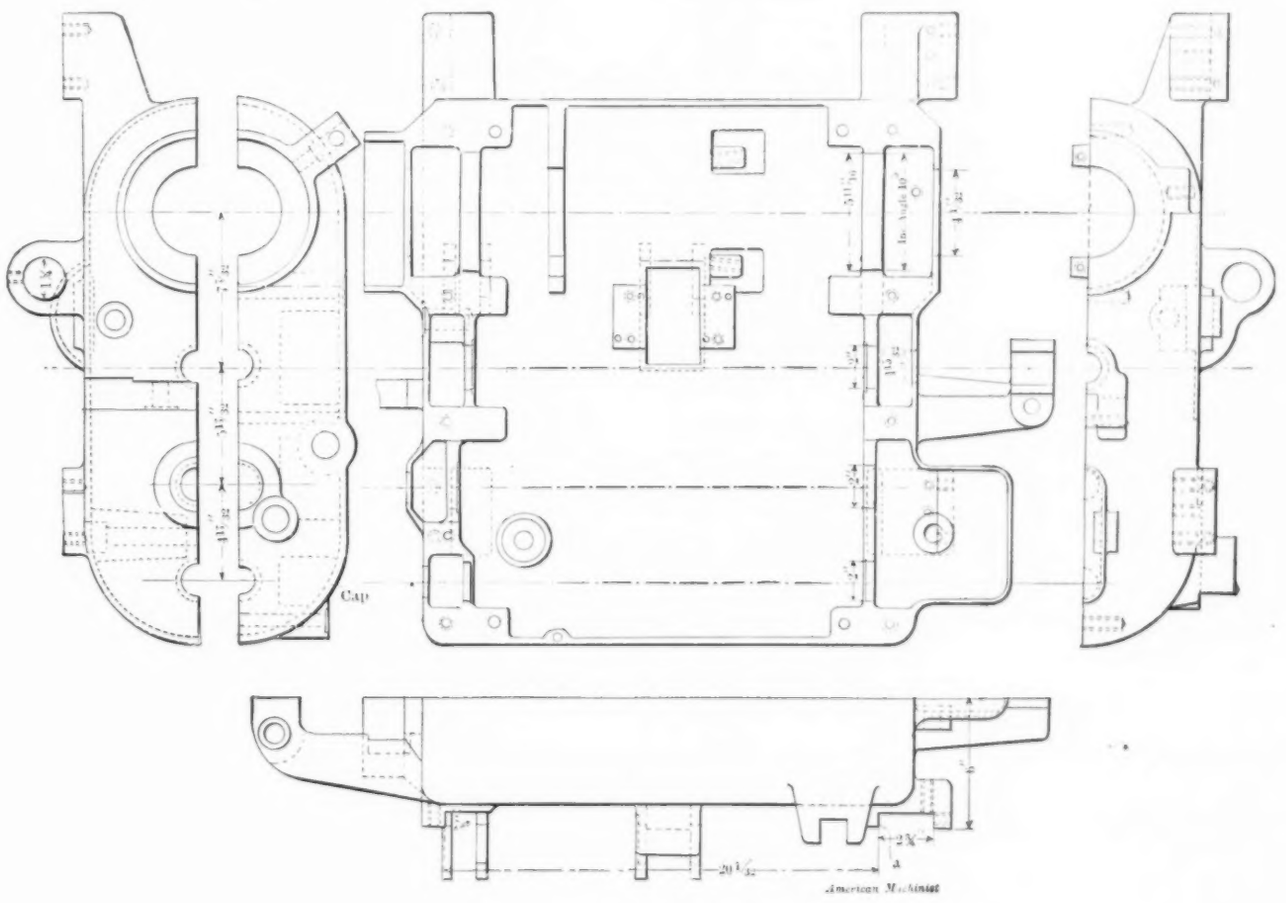


FIG. 1. 2X24 CROSS-FEEDING HEAD.

cored openings for the main boxes are about central with the boring bar. The bar is carried in bushings which keep it at the right hight, and parallel with the tops of the guides below and exactly at right angles with the length of locating edge *a*. It has a spherical end to receive a loosely fitting driving member and may

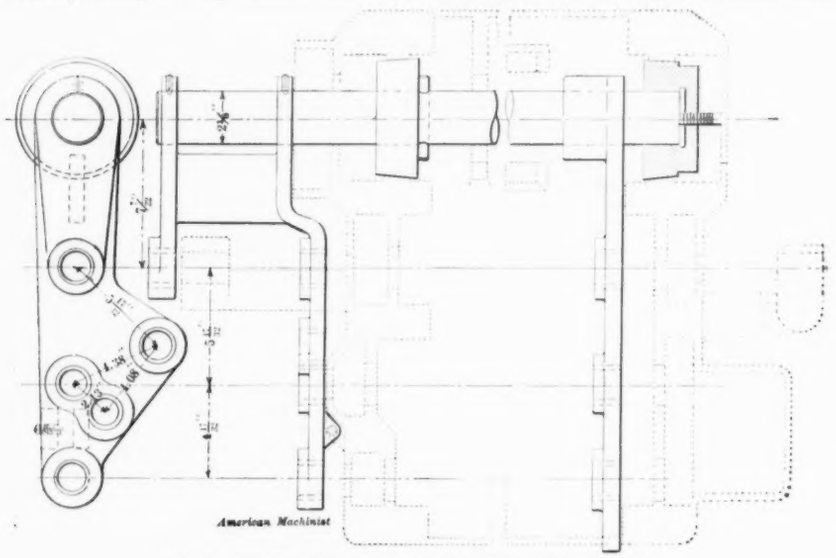


FIG. 3. JIG FOR BORING HEAD FOR GEAR SHAFT BOXES.

be operated satisfactorily either in a horizontal mill or vertically under a radial drill spindle, the fixture in the latter case of course being fastened to the side of the drill table.

There are two series of openings in the bar for cutters; and, as the conical seats for the spindle boxes are tapered in opposite directions, it is necessary to feed the bar first to right and then to left. At the first operation, cutters *b*, *c* and *d* respectively, bore out the clearance in the outer wall for the front end of the spindle, rough out the seat for the front box and finish this seat to correct taper. At the same time cutter *e* bores an opening in the rear outer wall to allow the rear end of the spindle to clear. Then two cutters like *c* and *d* (only opposite hand) are placed in the two vacant slots in the bar, the latter is fed in the opposite direction and the seat for the rear box formed, cutter *f* at the same time boring out the web indicated at *g* against which the thrust of the spindle is taken.

The next operation—boring the holes for the boxes for the different gear shafts in front of the spindle—is performed with the aid of the jig in Fig. 3. This consists of a pair of bushing plates hung on a shaft which carries also two guide cones corresponding to the spindle boxes and forced into the conical seats in the manner shown. The outer ends of the bushing plates are clamped against finished surfaces at the front of the head to assure their alinement, and then under the radial drill the short bearings into which the boxes will be forced are readily bored out to required diameter. The holes in the thin outer walls thru which the shafts project are formed with four-lip drills; the larger and more important holes inside to receive the boxes are finished with boring cutters.

The holes in the lower portion of the head to receive the shafts for the gears leading down to the friction feed disks are bored after the caps are removed by means of the jig in Fig. 4. The jig proper is mounted on the same locating arbor as the one in Fig. 3, but has in addition to that member and the taper bushings a second guide shaft corresponding to the shaft which carries the gear for driving the train leading to the feed disks. The two shafts or arbors thus locate the jig correctly, and with the work drawn back tight by bolts from the table the locating arbors are clamped between head and parallels, as represented, and the jig is held securely in position.

The heads are scraped to the fixture in Fig. 5, which is really a surface plate, having the bearings at the four corners in one plane. The work, with caps in place, is turned bottom side up, and the test bar and cones are slipped into position, one of the cones being adjustable on the bar by means of a stud and nut, which, when operated, bring both cones snugly to their bearings in the taper seats bored for the spindle boxes. Micrometer test screws are provided at each end of the affair, and at *h* is a true surface to which the important guiding surface *a*, Figs. 1 and 2, must be scraped. It is against this surface *a* that the device is held when testing; and not only must the flat bearings or guides under the head be scraped to a true plane and to show, by the test screws, dead true with the test arbor, but surface *a*, just referred to, must also be brought to exact right angles to the arbor.

The longitudinal ways on the bed and the carriage are scraped together, and then the guide surface, against which surface *a* in the head is held while in operation, is scraped square with the carriage ways by means of a gage, which is really a broad-face straight-edge formed at right angles to a body accurately fitting the carriage ways. This gage is clamped very lightly on the ways, and so that its straight edge is slightly behind the surface to be scraped. Then the latter is worked back until true with the straight-edge face. Next the crossways on the bed are scraped to the head, and the accuracy of the work is tested by a bar in the spindle bearings and an indicator mounted on the shears, any inaccuracies found at different settings of the head and position of the bar being corrected by rescraping the cross guides on the bed.

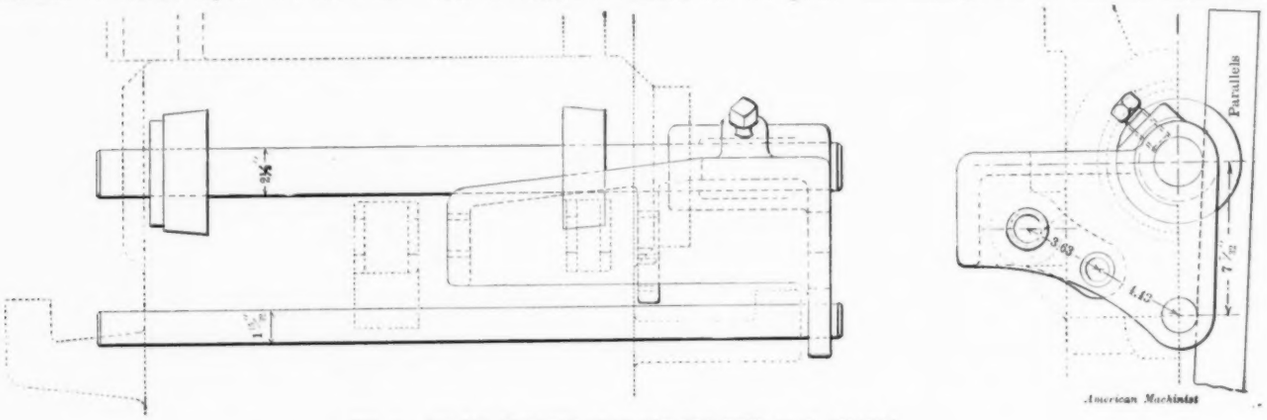


FIG. 4. JIG FOR DRILLING GEAR BOX FOR FEED GEAR SHAFTS.

The various holes in the bed for the bearings for different shafts, cross-feed screw, etc., are bored, of course, before scraping, this being done—after planing—

in a large horizontal mill. The jig for guiding the numerous drills and boring bars required is a convenient affair dropped on to the planed guides for the head and secured by hook bolts, stiffly ribbed lugs depending at front, rear and end carrying

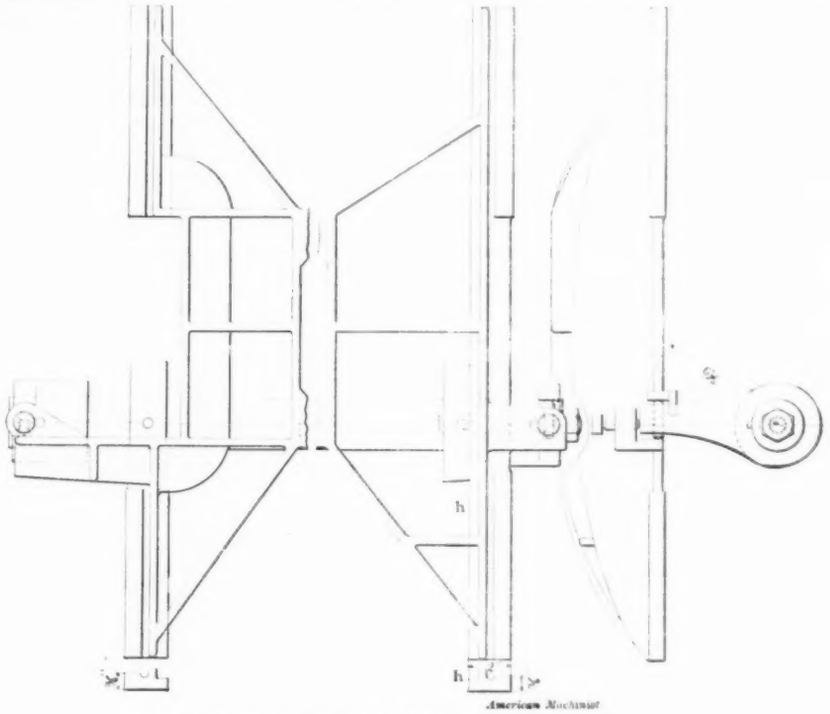


FIG. 5. SURFACE PLATE AND GAGE FOR HEAD.

the several guide bushings which insure the holes being properly located.

In the flat turret lathe description at page 845, a drawing of the turret slide was reproduced showing at the rear of the turret the six sliding dogs, placed side by side, for suspending over the stop-bars the twelve stops; also was mentioned at that time the arrangement of six semicircular pockets or recesses in the turret perifery, into which pockets, as the turret is turned step by step, the dogs slide one by one and allow their stops to drop. The ends of the sliding dogs are milled down from top and bottom alternately; that is, the first has a projecting lip left at the top, the next one a lip at the bottom, and so on, and accordingly the pockets for these are staggered or milled at two different hights about the turret base.

Now, while the turret is turned one-sixth of a rotation to bring each tool into position, it is evident that the recesses for the dogs must be spaced apart a distance equal to one-sixth of the turret circumference plus the width of a dog, as the six dogs are placed side by side. In other words, the pockets are 65 degrees apart and the last one milled consequently comes within 30 degrees of the first one, all of which will be understood by referring to the dotted outline of the turret in Fig. 6, which shows the milling fixture used for forming the pockets.

This fixture consists of a base plate *i* upon which is pivoted a carrier *j* for the work, the carrier being adapted to be swung about its pivot a certain distance by means of eccentric lever *k*, the hub of which bears always against the work perifery. The swinging arm or carrier

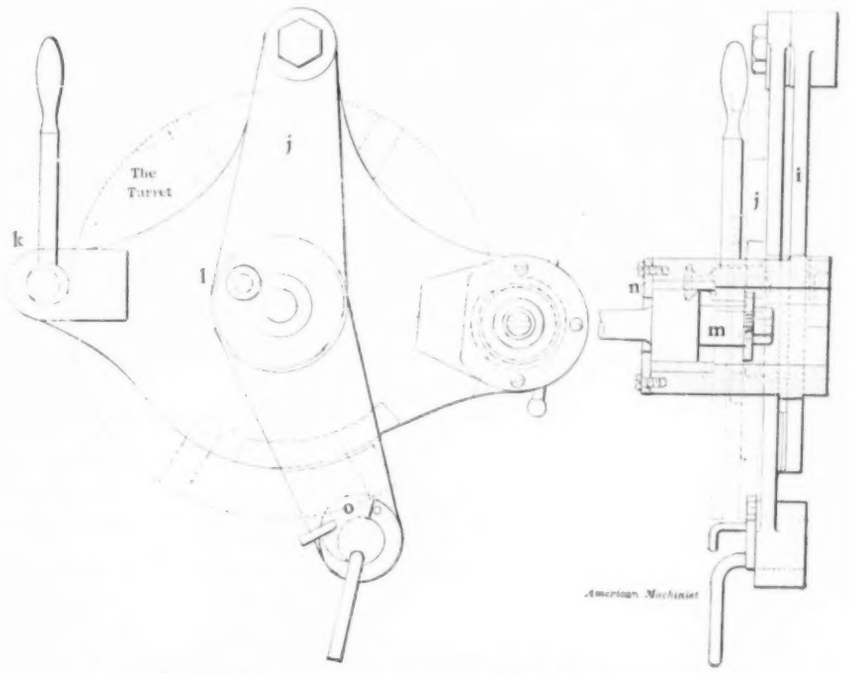


FIG. 6. FIXTURE FOR MILLING RECESSES IN PERIFERY OF TURRET.

is bored out at the center to receive the hub on the under side of the turret, and when the latter is dropped into place the pin *l* is slipped into a hole already drilled in the turret by means of a jig located from a tool slot. Thus the work is correctly located for the first cut.

The 3-inch mill is carried by spindle *m*, which has a taper shank to fit a drill press spindle; and the enlarged portion of the spindle is guided by a bushing fitted in the hub formed on base *i*. With the spindle drawn up, as shown, against stop-plate *n*, the work is forced over against the cutter by means of the cam lever and the first recess formed. Then the turret is swung back, the pin *l* removed and the work turned until stop cam *o* enters the semicircular pocket just milled and locks the turret in the right position for the second operation. The cutter spindle is now dropped to a stop, the cam lever again operated and a pocket milled in the lower edge of the turret.

Thus the cutter operates alternately in two different planes; and index cam *o* is therefore movable up and down to permit it to enter the recesses formed in either plane. F. A. S.

The Metric Movement in England.

A letter from Mr. James C. Stevenson, of Eltham, England, a chemical manufacturer and former Member of Parliament who opposed the metric bill of 1871, states that:

"Each of our two houses of Parliament has had a metric bill before them this session, but both have been dropped. Lord Kelvin introduced one and Sir John Brunner the other. The government supported the bill in the lower house only on the condition that Section IV, which proposed the compulsory introduction of the system after a small number of years, be dropped, the government amendment to Lord Kelvin's requiring the 'King in Council' to think well before they absolutely decreed the compulsory date and to note how far English-speaking nations were adopting the system."

The St. Louis Exposition—XIII.

EDITORIAL CORRESPONDENCE.

THE PRATT & WHITNEY EXHIBIT.

This exhibit contains three leading novelties of which the first, a high-speed lathe with gear-box headstock, is shown in Figs. 1 and 2. The motor will be seen to be utilized for the front leg of the machine. It is connected to the first motion shaft of the headstock by a high-speed chain, this shaft carrying a long pinion into which the intermediate gear meshes and around which the intermediate gear frame swivels. In Fig. 2, which shows the headstock with gear cover removed, the first motion spindle has a flanged belt pulley for use in countershaft driving, but otherwise this headstock is similar to the one shown in Fig. 1. The intermediate gear frame has a substantial slide with rack, pinion and crank by which the intermediate gear is moved to any one of four positions in which it is locked by a pin dropping into suitable holes in the frame, after which movement the frame is swiveled to drop the gear into mesh with the cone gear. A latch handle at each end of the frame holds the frame and gears in position after the gears are in mesh. The usual back-gears double the number of speeds given by the cone gears.

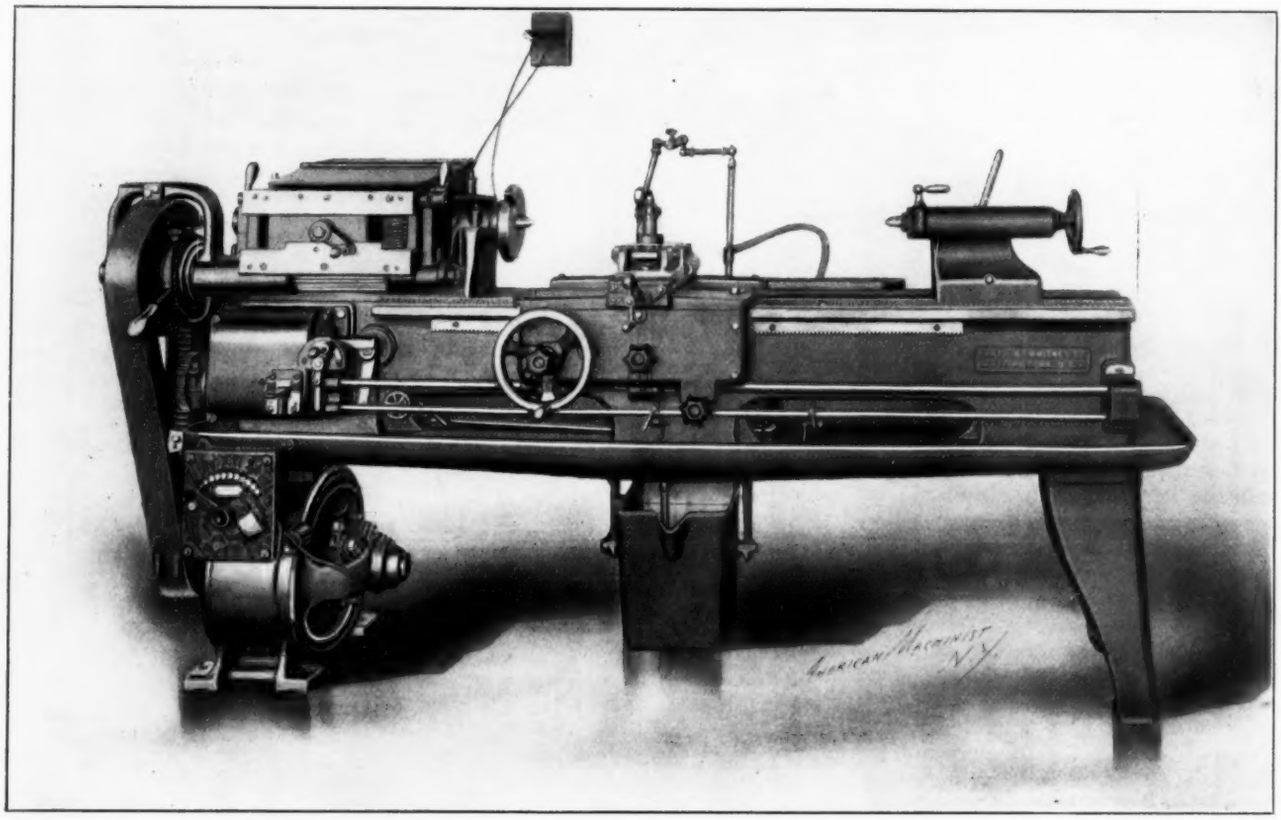


FIG. 1. HIGH-SPEED LATHE WITH GEAR-BOX HEADSTOCK.

Fig. 3 shows an automatic turret lathe with a new type of magazine of disk form and having a row of pockets around the edge in which the supply of castings is laid. At the proper moment the magazine is moved under the transfer fingers which then descend and grasp the casting when the magazine is drawn back and the transfer fingers drop to bring the piece in position in front of the chuck, from which position it is pushed into the chuck by the first movement of the turret. The chuck is operated by compressed air and thus accommodates castings which vary considerably in size. This machine, like several others in the Pratt & Whitney exhibit, is shown in operation.

Fig. 4 shows a 3x36-inch turret lathe having a new feature in the chuck. In handling such large stock as three-inch bars in a hollow spindle lathe, difficulties have been experienced, due to the variation in the size of the bars. This variation naturally grows with the size of the stock and to accommodate it considerable movement of the chuck jaws is necessary, and this, in turn, by reducing the leverage between the hand lever and the jaws, makes it difficult to get sufficient grip to drive the work. To overcome this the chuck in this machine is fitted with two levers of which the first, which gives the jaws considerable movement, is intended to bring them to contact only with the stock, when the second is manipulated and gives the grip—the force of this grip being the same regardless of the size of the bar.

THE CLEVELAND AUTOMATIC MACHINE COMPANY'S EXHIBIT.

The exhibit of the Cleveland company contains three important new features—a motor drive applied to a full automatic machine, a new magazine feed and a three-hole automatic machine. Of these the first two appear upon the same machine shown in Figs. 5, 6 and 7.

The necessity for driving the feed mechanism of an automatic turret machine independently of the spindle head makes the application of individual motor drive to such a machine a very different proposition from its application to almost any other machine tool, and, as will be seen from the illustrations, it has been worked out very neatly. Cast with the front leg to the machine is a platform on which the motor is mounted, and this, thru a silent chain enclosed within a cast frame and a friction clutch *a*, Fig. 6, drives the shaft *b*, a self-alining bearing being interposed at *c* to provide for any spring of the platform. The object of the clutch is to permit instant stoppage of the machine by the handle *d*, and without stopping the motor. At *e* is a silent chain drive to the main spindle thru the reversing clutches *f g*, and at *n* the shaft *b* enters a gear box containing change gears by which the feed can be changed independently of the main spindle. From gear box *h* proceeds the feed shaft *i*, which, thru the miter gear box *j*, drives shaft *k*, from which in turn the feed is driven by a silent chain.

The new magazine feed is shown in Figs. 5 and 7, the former showing the magazine tilted out of the way, as it stands when the cutting tools are at work, and the latter in the position occupied when a piece is being transferred to the

conveyor, which occupies one of the holes in the turret. Fig. 7 shows also in dotted lines the idle position of the magazine, from which it will be seen that it is entirely out of the way of the turret tools and that it does not interfere with a forming or other tool in the back cross-slide tool-post.

The magazine—called a tilting magazine—swivels about the shaft *a*, Fig. 7, on which it is adjustable lengthwise to accommodate various pieces of work. Thru the three-armed lever *b c d* slotted plate *e* and cams *f g* the magazine is brought to the transfer point at suitable times and returned again to the idle position after a piece has been taken from it. These cams are permanent for all classes of work. Stop-levers *h i* with tail pieces *j k*, which abut on suitable stop pieces as the magazine comes to the operative position, serve to deliver the pieces one at a time, lever *h* holding the pieces back, as shown in the main view, during the time that lever *i* is withdrawn to permit a piece to be taken from the magazine, and lever *i* retaining them at other times as shown in the dotted view.

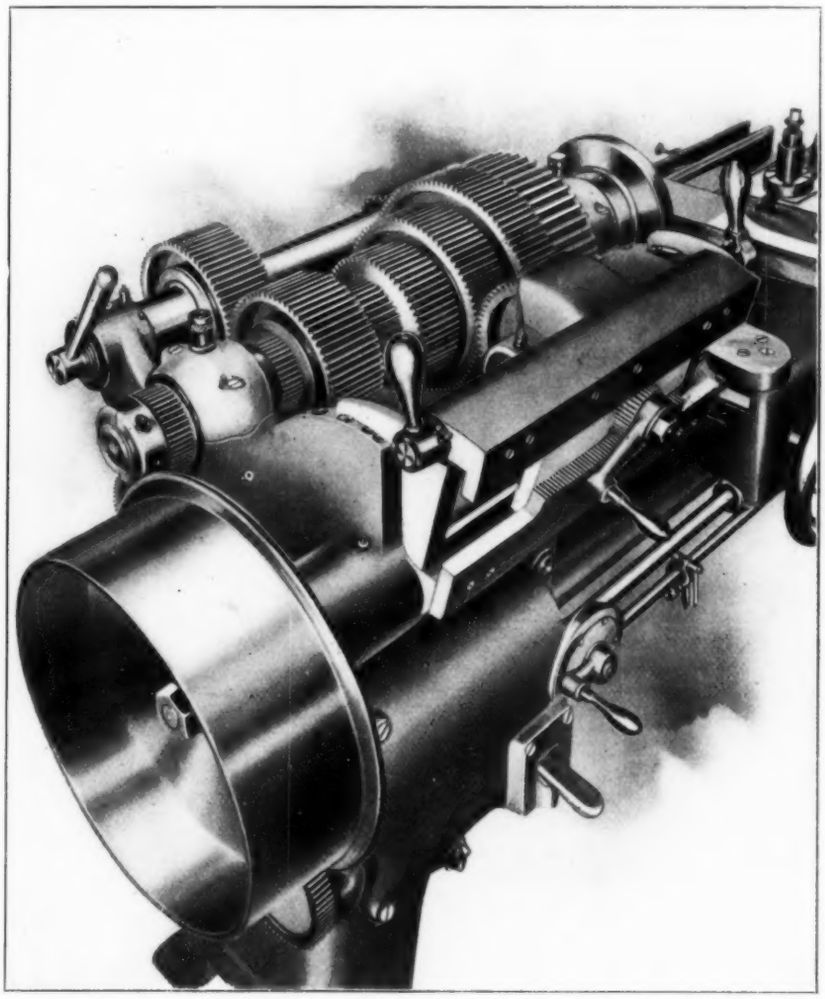


FIG. 2. HEADSTOCK OF HIGH-SPEED LATHE.

The three-hole turret machine, of which the leading special features are shown in Fig. 8, has been designed to do that large class of first and second operation work which does not require the more elaborate machine. Moreover, by avoiding the idle movements due to the skipping of turret holes which are not used, it saves considerable time, especially when it is considered that the simple pieces for which the machine is intended—studs, pins, etc.—are usually required in large quantities. In addition to this, the machine is so made that the turret does not make its full traverse except when necessary. In taking a short cut near the chuck end of a piece, the turret advances rapidly until the cut is reached, then slowly during the cut and then withdraws rapidly, but only far enough to clear the work, whatever the length of the latter may be, the turret being turned over at any point desired. The turret is also adjustable along the bed thru a range of 10 inches to suit different lengths of work.

Referring to Fig. 8, the turret is unlocked by the face *a* of the double cam *a b*, and then rotated by the face *b*, the former movement being positively in advance of the latter. Face *a* acts thru roll *c*, lever *d*, shaft *e* and lever *f*, while face *b* acts thru roll *g*, lever *h*, pawl *j* and index plate *k*. The cams for feeding the turret are upon the outside of the drum, having *a* and *b* upon the inside, and by simply omitting the parts of the cams which would, if present, give the full traverse of the turret, the traverse is shortened to suit the piece of work being done. The high-speed idle-movement feature of the feed is the same as that described at page 450.

F. A. H.

ndustrial Education in Germany—II.*

BY UNITED STATES DEPUTY CONSUL MEYER, CHEMNITZ, GERMANY.

CLASSIFICATION OF GERMAN INDUSTRIAL SCHOOLS.

The industrial schools of Germany can be arranged in numerous groups under many heads. All have their individual peculiarities and their common characteristics. Their relationship is many-sided, and relationship is the determining element in the process of classification.

CLASSIFICATION BY ENTRANCE REQUIREMENTS.

On the basis of the scholarship requirements for admission and the aims in education, three general classes of schools may be distinguished: Lower industrial schools, middle industrial schools, and higher industrial schools. Each of these classes is important in its place, and performs an important mission. Each class developed because it was needed. Originally there were only the lower and the higher industrial schools. Their curriculums, however, could not meet the demands of German industry. The lower industrial schools taught too little and the higher schools taught too much. The former sent young men into the world who were not fully prepared for the task before them, who were not equipped to master the technical problems that presented themselves in their trades, while the latter claimed the time of the student for so many years that the most advantageous age for beginning the work at a trade had passed. In addition to this the student found himself burdened with theoretical knowledge far beyond the needs of his calling, and absolutely worthless in the solution of the problems that came to him. A middle class of schools was required. The need grew pressing. The laws of evolution operated, and the schools were organized. The process of their growth and distribution over the Empire is not yet complete. Parts of the country, as Prussia, need more of them, especially engineering schools. Evidence of the insufficiency of the middle industrial schools in Northern Germany is found in the large number of young men from that part of the country who annually visit the Industrial Academy of Chemnitz and Mittweida Technikum (both Saxon schools of the middle class) and take work especially in mechanical and electrical engineering. To meet this demand the number of

*Abstracted from Consular Reports.

schools of this rank in Northern Germany is annually increasing.

A few words more now as to the aims, the curriculums, and the general relations of these three classes of industrial schools:

LOWER INDUSTRIAL SCHOOLS.

General Character and Aims.—This class of schools comprises all those institutions, beginning with the lowest, or primary, industrial combination schools which strive to give a general, practical, but very rudimentary, trade instruction, mainly in the evenings or on Sundays, and ending with the special trade schools which aim to teach only the most necessary technical elements of a trade. It includes all the smaller trade schools, such as the schools for weaving, spinning, knitting, lace making, embroidery, burling, darning, rope making, basket making, tailoring, hair cutting, wood carving, clock making, masonry, architecture, ribbon making, and the numerous other special trades.

There are included also certain "courses" and "schools" which are associated with many of the special trade schools, tho not an integral part of them, such as the experimental shops, practise courses, workshops, workmaster schools, and others. These are auxiliary institutions. They are either complementary or supplementary. They are complementary when, as in case of the experimental shops and workshops, they are used by the students simultaneously with their studies in the professional trade schools as aids in grasping the practical elements of the work. They are supplementary when, as in the case of the practise courses and workmaster schools, they are used by the student after the completion of his work in the special trade school to supplement its courses and to compass the more difficult technical problems of his trade, as well as to keep him posted on its latest advances and most modern methods.

Experimental Shops.—The experimental shops have been found of great value. Many special trade schools are said to have been but partially successful in their results until the establishment of experimental shops. In these workshops the student is given the widest opportunity to apply his knowledge. The field of experimentation is boundless in any trade. The secrets are never all told, the mysteries never all solved. The hope of reaching something unknown, of discovering something of value, is one of the most powerful incentives to persistent application and careful research, both of which are of inestimable value in training the mind and the hand for the work of a lifetime. Theoretical knowledge can here be turned to practical account. The vague and hazy becomes plain and simple in the light of concrete objects. The experimental shop is the shop of progress.

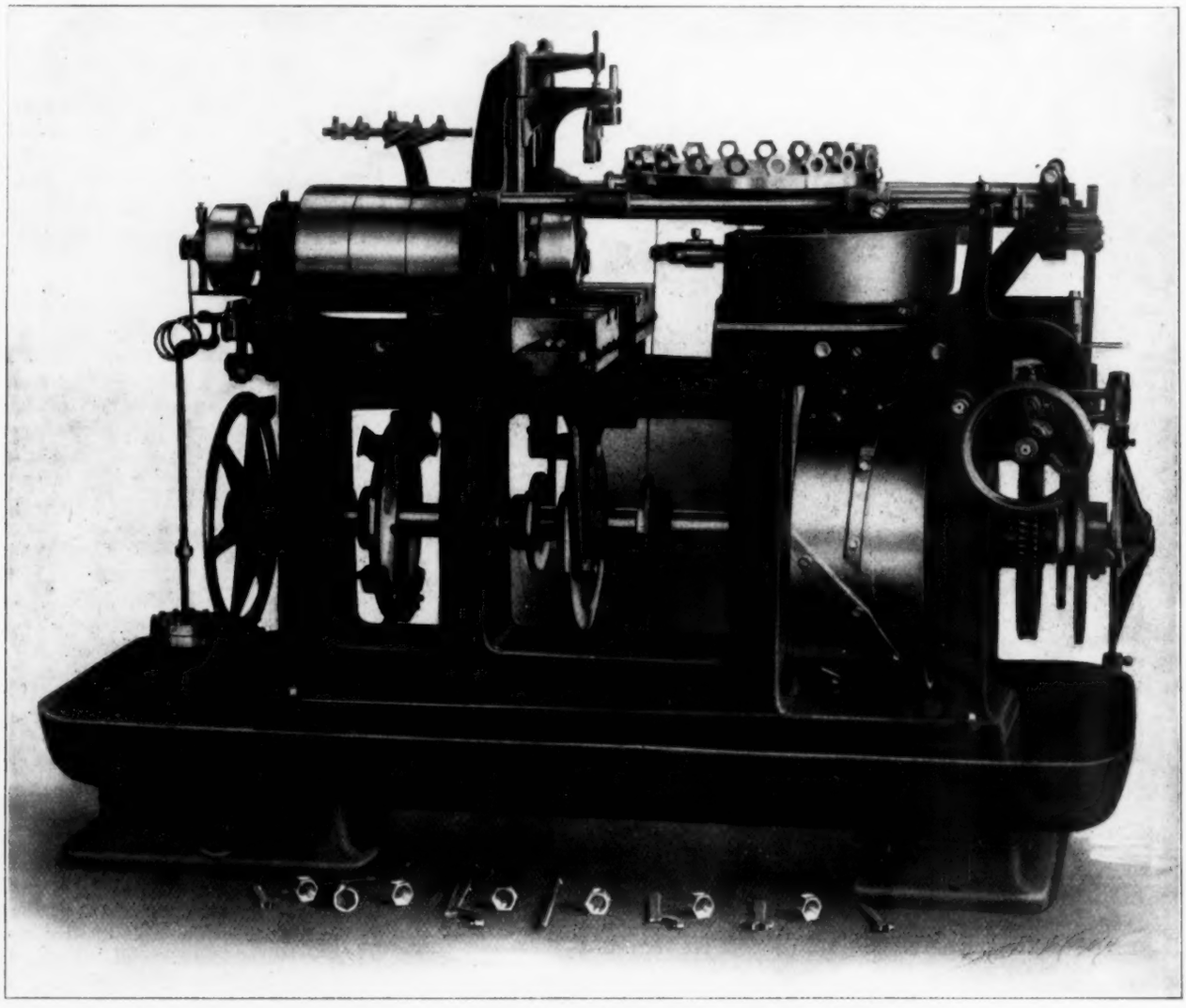


FIG. 3. AUTOMATIC TURRET LATHE WITH DISK MAGAZINE FEED.

The Workshop.—The workshop is distinguished from the experimental shop in that the former is intended primarily to offer practical experience in the conduct of a trade, free from all tests, experiments and research, while the experimental shop is primarily for the application of acquired knowledge, for inquiry into the unknown, altho this necessarily also involves considerable valuable practise in a trade. Some German manufacturers are said to complain that the workshop makes the student too one-sided and gives

him a narrow training. Another objection raised is that the student gets into bad habits in the practise of economy. He generally gets all the raw material that he needs, it is claimed, and this makes him a spendthrift in active business. Here, however, the blame must be charged not to the workshop, but to its director. These shops are quite common in Germany. No modern statistics are at hand, but Baden alone had 104 such shops in 1896. All are reported to have received government aid.

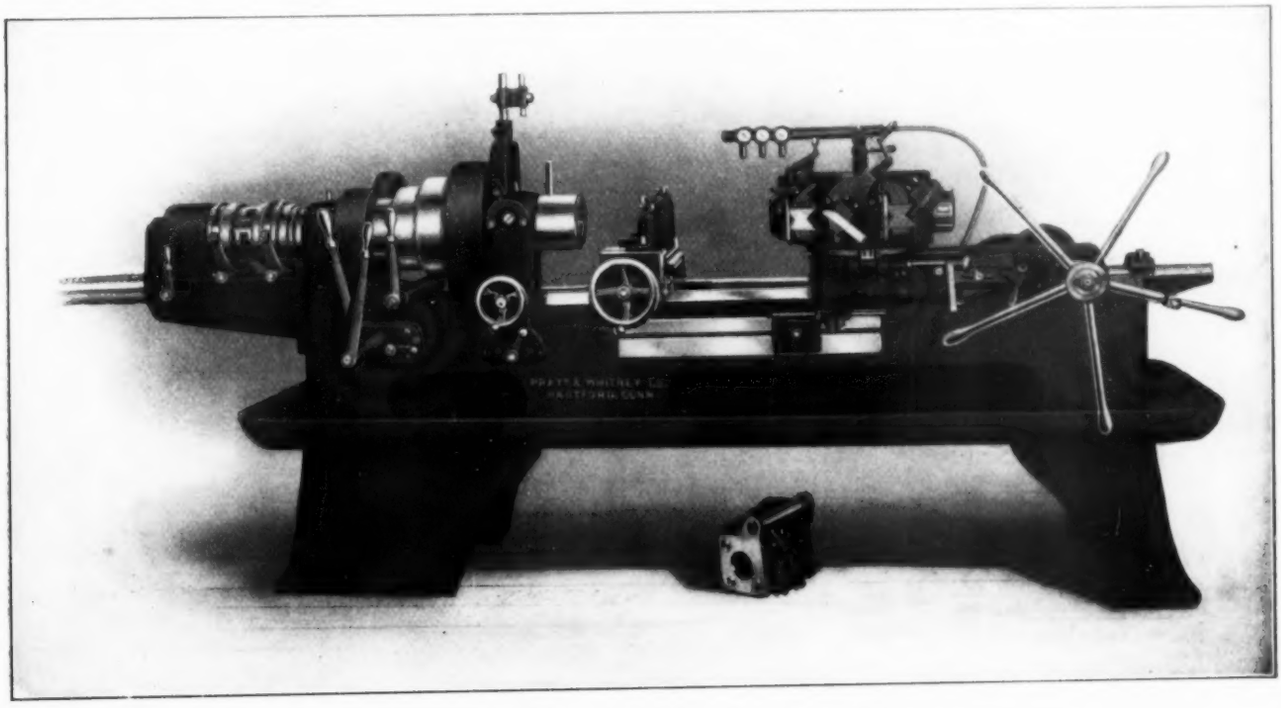


FIG. 4. 3x36 TURRET LATHE WITH AUXILIARY CHUCK LEVER.

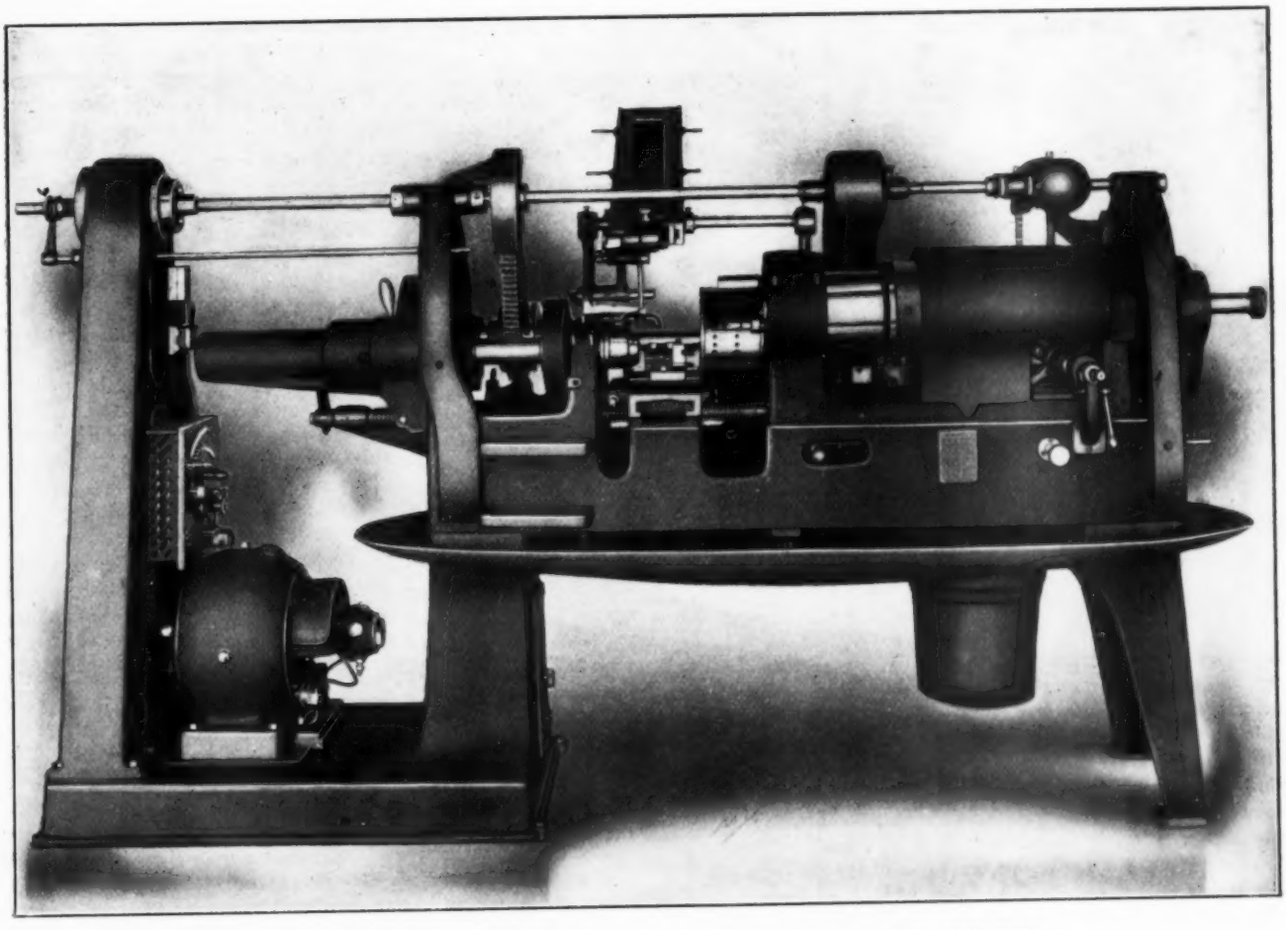


FIG. 5. MOTOR-DRIVEN AUTOMATIC TURRET LATHE WITH TILTING MAGAZINE FEED.

Practise Courses.—These courses are designed for "masters" (Meister) in a trade, and are to furnish opportunities for their meeting. At the meetings the latest advances of the trade are discussed, papers are read and social greetings are exchanged. The success of these "courses" seems to rest largely upon the principle that when a number of tradesmen, who each know a little of the news of their trade, get together they will, as a body, know a great deal. It is obvious that much can be done for the advancement of the local interests of an industry thru the exchange of ideas and the discussion of trade reports and technical papers.

Workmaster Schools.—These institutions are far more pretentious than the practise courses in their aims and in the importance of their curriculums. Some of them pursue work of such a grade that they assume a much higher rank than would justify their classification among the lower industrial schools. Most of the institutions, however, belong to this class. The workmaster schools, as the name implies, were established for the further instruction of masters in a trade. They were organized in recognition of the inadequacy of instruction offered in most of the professional trade schools, in which work is frequently done by students in the evenings or on Sundays, when the body is weary from a day's or week's physical exertion and the mind is dull from the fatigue of the body. These schools have been organized for all the more difficult trades. The entrance requirements generally are an age of at least sixteen years and two or three years of practical experience in the trade. The courses cover about one year to one and one-half years, with thirty to forty hours of instruction a week. They confine themselves closely to the immediate needs of the trade, and can for that reason accomplish much in the time allotted to study. In 1855 the Saxon Government established a number of such workmaster schools, which were open, however, only to the "best and most industrious students" of a trade.

MIDDLE INDUSTRIAL SCHOOLS.

The middle industrial schools rank between the lower trade schools and the associated institutions, just discussed, and the higher engineering schools and technical high schools. The need for this class of institutions is readily seen. Entrance into the technical high schools calls for graduation from a gymnasium, or some equivalent, so that the graduate of the German technical high school has probably attained his twenty-fourth year (estimate of Professor Roscher, Leipzig). The education which he acquires exceeds by a liberal margin the needs of numerous industries. There are many positions somewhat less than the highest rank which must be filled from somewhere by well-trained technologists, tho graduation from a technical high school is unnecessary. The completion of a technical high school

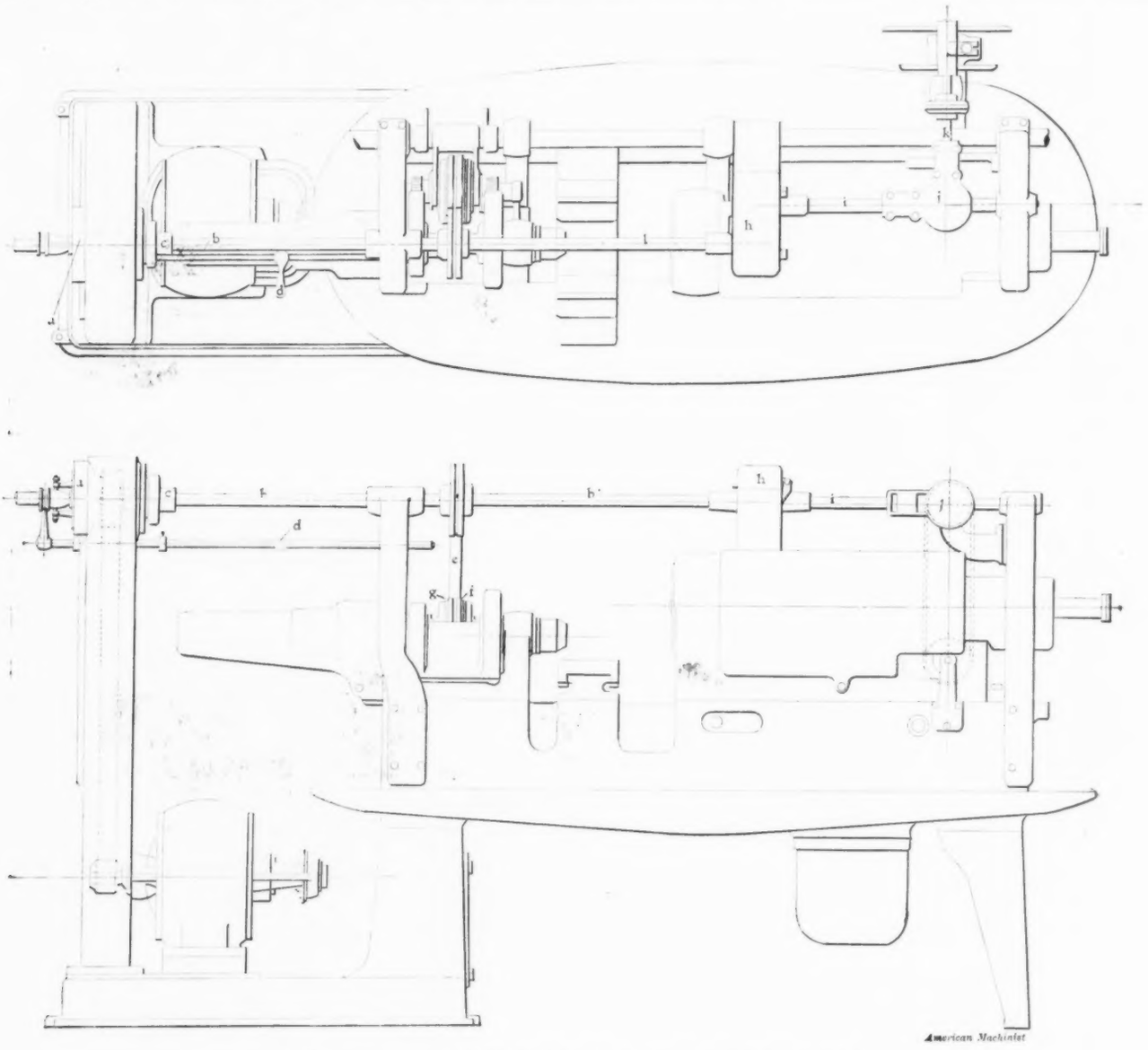


FIG. 6. DRIVING SYSTEM OF MOTOR-DRIVEN AUTOMATIC TURRET LATHE.

course lets the right time pass by for the acquisition of practical experience; it takes much time and money, and it unnecessarily exposes the student to the trying and sometimes disastrous influences of academic freedom such as is the privilege of a student at any of the highest educational institutions of Germany.

To avoid these difficulties and to provide a quicker and sufficiently adequate training for young machinists and technologists in the middle branches of industry, the middle industrial schools were organized. This class of men had to be educated somewhere. If they went to the lower industrial schools there was danger that they would raise the standard of these schools too much, and thereby destroy their efficiency in ministering to the wants of the lowest ranks of trade; if they attended the technical high schools there was danger that they would lower the grade of work therein too much by requiring the introduction of courses below those already offered, thereby endangering the position of these great schools as leaders among the technologic institutions of the world. The place filled by the middle industrial schools is shown by the fact that, according to Professor Roscher, in 1898, these schools supplied 2,157 out of 3,281 engineers, or 66 per cent., employed by 105 prominent German manufacturers. Most of the remaining 1,124 positions were filled from the technical high schools, and a majority of them were of such importance that only graduates of technical high schools could competently fill them. The first of the middle industrial schools was established in Chemnitz in 1836, and at present has almost 6,000 students, coming from all parts of the empire.

HIGHER INDUSTRIAL SCHOOLS.

The class of higher industrial schools embraces the highest Technika, or institutes of technology, the highest engineering schools and the technical high schools. Some writers class the Technika and the engineering schools with the middle industrial schools, and place the technical high schools in a class by themselves. When the high standard of work in the former institutions is considered, it will be apparent that by placing them in the middle class this group of schools will be made quite too all embracing, however much the technical high schools may deserve their lofty position among the finest technological institutions of the world.

The main special characteristics of the class of higher industrial schools are, more difficult entrance requirements than the lower class of schools, more and deeper theoretical instruction, more expanded curriculums and longer courses. From these institutions go forth the men who are to become the leading technologists of the German Empire and, in many cases, of the world. Many of the graduates find their way to other countries. The great factories and transportation agencies of all the leading lands employ hundreds of technologists who have received their training in the German technical high schools. At the famous technical high school at Berlin-Charlottenburg one may find in attendance young men from England, America, Russia, France, Italy, Spain, Belgium and many other countries. These schools offer the best and highest technical instruction that can be had. They are paid tribute by the press in all countries. They constitute the world's laboratories for technical research and are aids to the advance guards of technical progress.

The schools for industrial art, which have hitherto not been mentioned, are the most recent in origin of all the industrial schools. They aim at the utilization of art in industry. They strive to teach the method and develop the ability of applying the graceful and harmonious forms of the artistic in nature to practical objects of trade and consumption. What once was made simple, durable and serviceable is to be so produced that it may, in addition to these necessary qualities, also possess the attraction of things beautiful. In short, the artisan in any trade is to be more than a mere mechanical producer of useful commodities. He is to learn how to add to his work the touch of the artistic, the form of the beautiful, the attraction of the graceful, the calm sense of the harmonious. Wonderful is the work that has already been accomplished in Germany by these schools. In shop windows

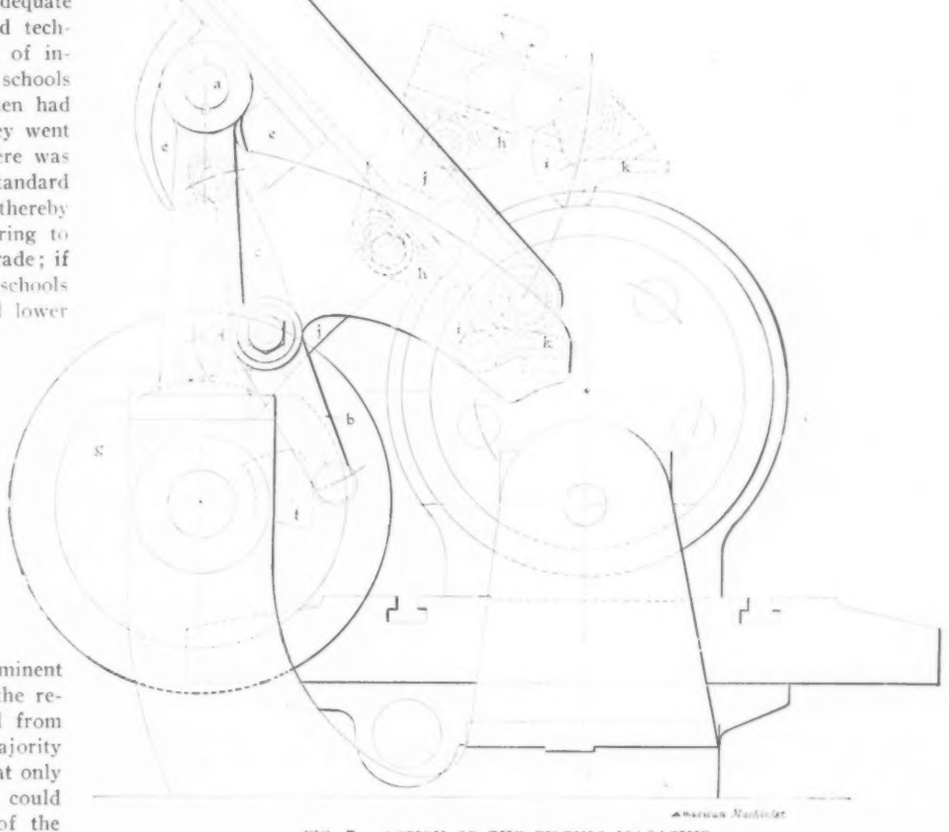


FIG. 7. ACTION OF THE TILTING MAGAZINE.

everywhere the lavish display of countless beautiful conceptions of industrial art are eloquent testimony of the effectiveness of these institutions.

An Odd Spacing Attachment for the Milling Machine.

BY A. CASHMAN.

Within the past year I have been called upon to design for the milling machine several attachments which were of a very peculiar nature, in that they were required to produce odd work. I here wish to describe one which I consider to be one of the most difficult, in the hope that it will help some other fellow out of a dilemma.

The company by which I am employed manufactures a line of machines in some of which printed matter is used rather extensively. These printed sheets are made up in cylindrical form and are 26⅝ inches in circumference by 13⅝ inches long. On these cylinders are 15 columns of figures, 320 figures in each, running around the cylinder. Each column of figures from 1 to 15 is different, in that the numbers in each have a higher value than in the one preceding it. It was desired to combine with each column of figures a row of dots or graduations that would correspond in units to the value of each column. The first step to this end was to find out from the type foundry if they could furnish the type to produce these dots or graduations. Upon inquiry and a visit of one of the agents of the foundry, it was found to be impossible for them to supply our wants because the spacing of the graduations was so odd that it could not be worked out with the point system. It therefore fell to my lot to devise some means of cutting these graduations in the shop from brass rules which could be obtained from the foundry.

My first attempt was with different combinations of gears and index plates attached to the feed screw of the miller. I had not gone far, however, when I discovered that such was out of the question, owing to the high multiplication which must be had and the consequent chance for error in the finest graduations, which were $37\frac{11}{21}$ to the inch. I next tried odd pitch screws, but soon gave this up also, owing to the great expense it would involve. Then came about two weeks of hard thinking with no result, at the end of which I opened correspondence with a firm manufacturing milling machines, in the hope that they would be able to shed some light on the subject. After corresponding for a week or ten days they wrote that "it was a hard nut to crack" and "threw up the sponge." Therefore I was again thrown upon my own resources and was nearly at my wits' end for two weeks more. Finally, hitting upon a new idea, I decided to put it in operation and did so with very gratifying results. Following is a description of the attachment used and its operation, together with the data for this particular case:

A is a gray-iron bed-plate which is bolted to the table of the miller. On the plate is a guide *B* which carries a slide *C* to which is bolted a common milling machine vise *D*, in which the work is clamped. On the right side of slide *C* are cast two projections *E* and *F*, and also on the bed-plate *A* are bolted two more, *G* and *H*, these serving to hold down the gray-iron wedge *I*. Mounted on the plate *A*, with the screw *J*, is a lever *K* which operates on the pin *L*, this pin being inserted in the holes *M* and changed from one to the other as the wedge *I* advances. The pin *N* serves as a stop for lever *K* so as to prevent it from passing the right angle to the taper of wedge *I*, which if done would force the wedge away from its bearing *O* on the plate *A*. On the wedge *I* is fastened a metal strip *P* on which is a series of graduations designed to cut the desired spacing. *Q* is bolted to the slide *C* with the bolt *U* and projects over the strip *P*, thereby serving as an indicator in the operation of the wedge. Mounted on the bed-plate *A* are two pulleys *R* and *R'* over which are run two ropes *S* and *S'*; one end of each rope is fastened to the slide *C* and on the other end is hung a 50-pound weight. This arrangement always keeps the slide *C* against the wedge *I*. The bolt *T* is used to lock the slide *C* before cutting each tooth, thereby avoiding all chance of said slide moving during the operation.

As already stated, there were fifteen columns of graduations, each 26⅝ inches long and different from the others. The following table shows the number of graduations to each column, and also the spacing on the strip *P*.

Column No.	No. of Grad. to 26⅝"	Spaces per in. on P.
1	340	3⅜
2	360	3⅜
3	400	4
4	440	4⅜
5	460	4⅜
6	500	5
7	540	5⅜
8	560	5⅜
9	600	6
10	640	6⅜
11	660	6⅜
12	700	7
13	800	8
14	900	9
15	1,000	10

It would be impossible to cut the graduations for each column in one piece, so the distance 26⅝ inches must be so divided as to cut several at a time. It will be noticed that the number of graduations in each row is divisible evenly by

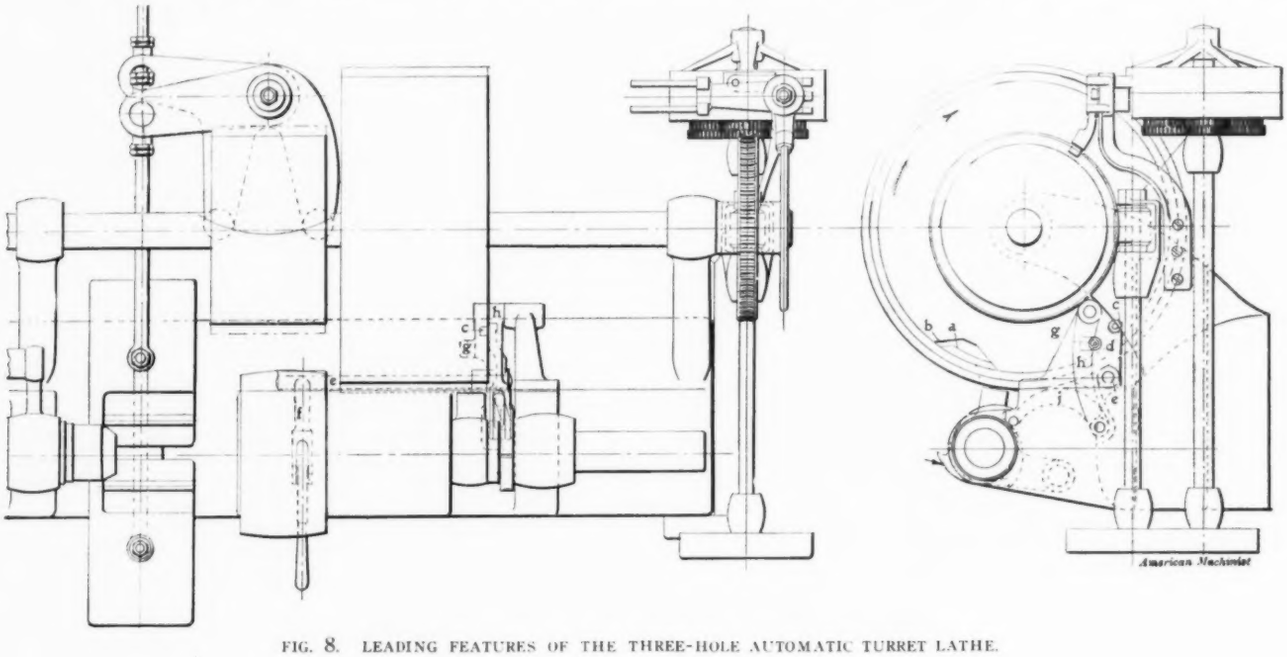
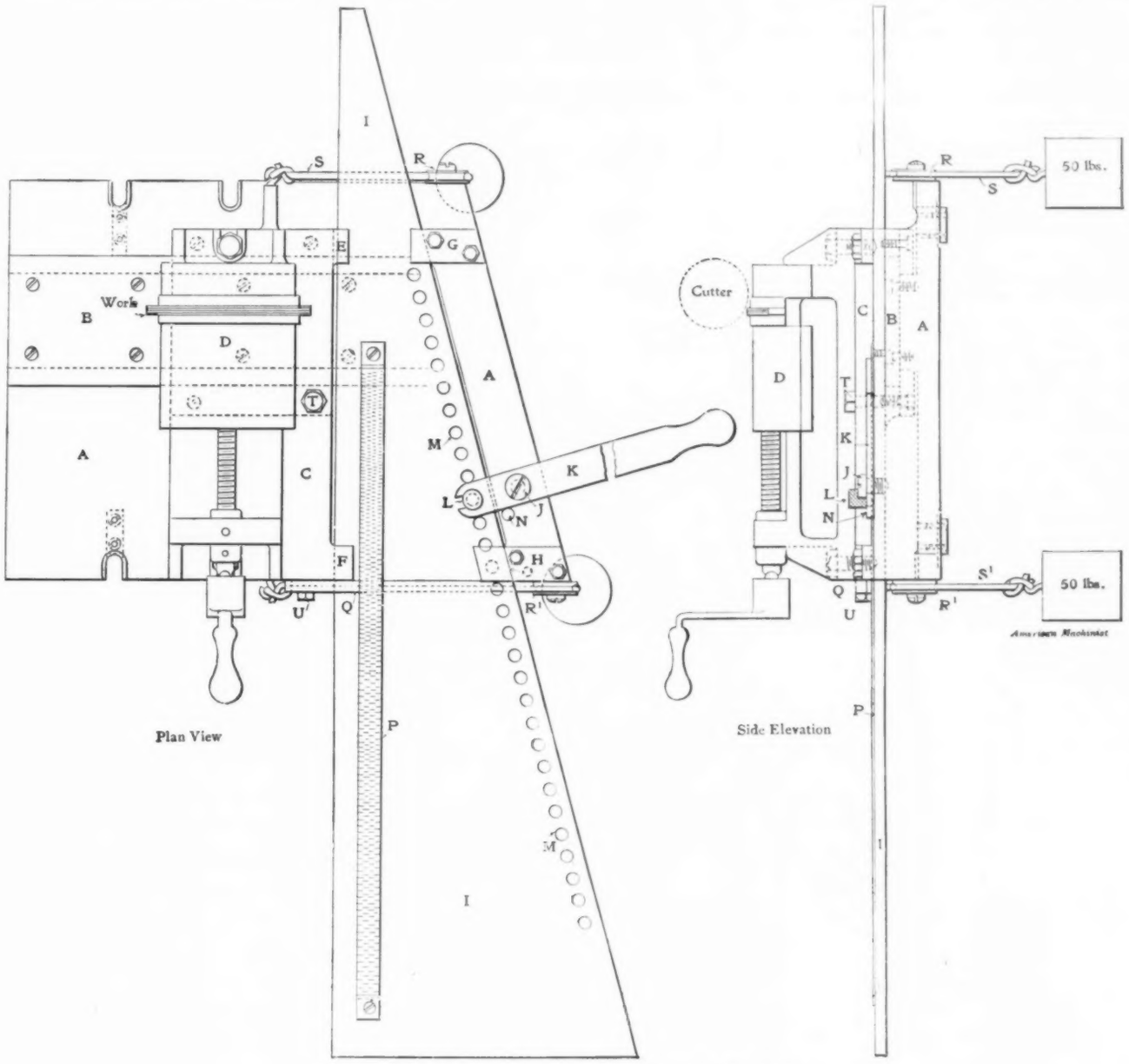


FIG. 8. LEADING FEATURES OF THE THREE-HOLE AUTOMATIC TURRET LATHE.

5 and 2. As the latter would make the sections 13 5-16 inches long, it would not do, so 5 was resorted to, thereby making five sections to each column, each 5.325 inches long. This division caused the sections to match each other when placed end to end, and enabled the operator to cut all five or one complete column at the same time, as the number of graduations in each was divisible evenly by 5.

The rules which were to be used for the angle of 14° 54′. The number of graduations in each column divided by 5 (the number of sections to each column) and the quotient divided by 20 (the travel of the wedge in inches to one-fifth the length of each column) gives the number of spaces per inch on the strip *P*. For example, in the first column there are 340 graduations; this divided by 5 gives 68 and this divided by 20 equals 3⅖ spaces per inch.



AN ODD SPACING ATTACHMENT FOR THE MILLING MACHINE.

purpose, however, came 7 inches long; so it was decided to cut the graduations the full 7 inches and afterward cut the sections down to size (5.325 inches), thereby leaving extra pieces which could be used in case of emergency. To get the taper of the wedge *I* and the spacing on the strip *P*, the following method was used: A travel of the wedge of 20 inches was decided upon to cut one-fifth the entire length, or 5.325 inches, which gave the

To cut the graduations in 7-inch sections it was necessary to make the wedge *I* and strip *P* proportionately longer than would have been necessary had the rules come cut to size (5.325 inches).

By dividing the number of graduations in each column by 26⅝, the total length, it will be noticed that the number per inch is extremely odd, and I therefore consider this method the most practical for any job in which the conditions are similar.

Richard Recording Differential Kinemometer.*

M. d'Arsonville recently described to the Academy of Sciences, in France, a new instrument devised by the great specialist, Jules Richard, to show the variable angular displacements which exist at each instant, in an actual motor, between its crank and that of a similar ideal motor, driven at the average speed of the motor considered, with a rigorously uniform motion. This instrument was called out by the International Society of Electricians, which, May 6, 1901, started a competition for an apparatus to facilitate the parallel coupling of alternators, and capable, for this purpose, of revealing irregularities of 1/250 of a revolution in the running of a machine making 125 turns a minute.

The constant-speed mechanism of comparison employed in this instrument is a clock movement so regulated as to give

*Translated from *Revue Industrielle* by E. P. Buffet.

a uniform motion. The uniform rotation is communicated to a combination of two friction disks acting on a friction wheel whose radial position on these two disks is adjustable by means of a thumb worm. The friction wheel thus transmits a more or less rapid movement to one of the bevel gears of a differential train, the opposite gear of which is driven by the shaft of the machine that is to be tested.

By suitable regulations of the position of the friction wheel it is possible to make the first bevel gear turn at the same speed as the second and, in consequence, the mechanism dependent on the two wheels remains perfectly motionless at the mean speed of the machine to be tested.

Variations above or below this speed are then rendered visible by a needle connected with the differential mechanism.

The barrel or spring-box D, Fig. 3, of the clockwork is contained in a box H, Fig. 1; it drives, thru gearing, on one side a needle A marking seconds on a dial C, and on the other side the two friction disks $E\,E^1$, turning in opposite directions by means of the gear wheel E^2.

Against the back side of the box H, Fig. 2, is arranged to slide a carriage F on which is mounted a spindle F^1 carrying at the one end the friction wheel G and at the other end a long pinion G^1 which meshes with a wheel H^1, toothed on the face. The wheel G is driven by the rotation of the disks $E\,E^1$ one of which, E^1, is kept in permanent contact with it by a light spring E^3.

To allow adjustment of the position of the wheel G in relation to the center of the wheel $E\,E^1$, the carriage F carries a rack.

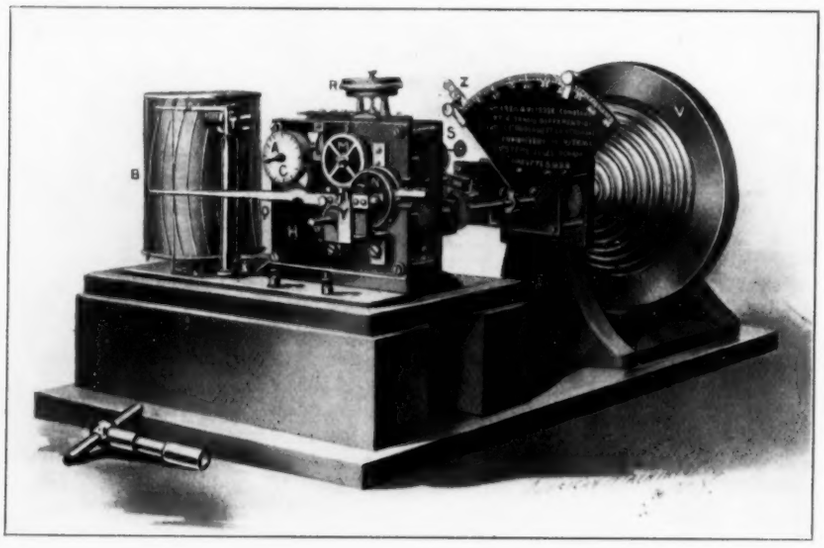


FIG. 1. RICHARD RECORDING DIFFERENTIAL KINEMOMETER.

on the same shaft with whose pinion J is a worm gear J^1; the worm J^2, provided with nurled button S, thus serving to move the rack. The shaft of the gears J and J^1 carries on the front side of box H a graduated circular scale M, Figs. 1 and 3, which turns below a fixed needle, thus giving the speed which in the machine that is being tested corresponds with the position of the wheel G.

The rotation of this last is transmitted by the gear H^1 and a spur wheel H^2 mounted on the same spindle to a smaller gear H^3. [In Fig. 3 H^3 seems to be hidden by H^2.] This is loose on its spindle O and rigidly connected with a bevel gear O^1 which meshes with the two opposite bevel gears belonging to the mechanism controlled by the differential.* These latter are themselves engaged, on the side opposite the wheel H^3, with a gear O^2, similar to O^1 and driven from the shaft of the machine undergoing test by any coupling device, whether mounted on the shaft P or the shaft P^1. A system of gearing P^2 serves to reduce the speed or to reverse the direction of the motion, which is not indifferent.

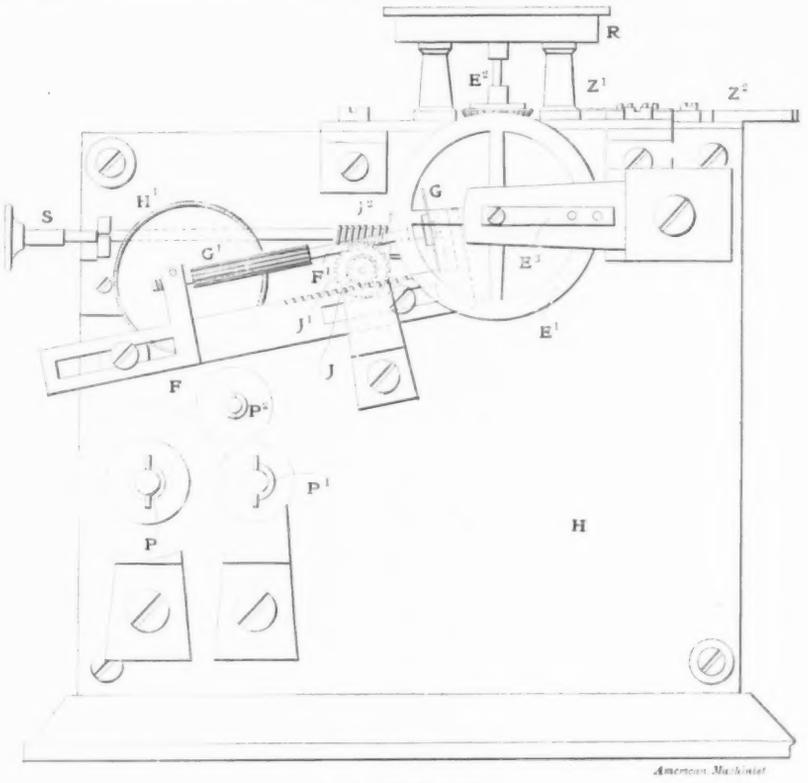


FIG. 2. REAR VIEW.

The spindle O, on which the gears O^1 and O^2 are loose and which carries the mechanism dependent on the differential terminates at the front side of the box H, in a clutch wheel N, finely toothed on the face.

The index needle Q is carried by a spindle Q^1 set in two boxes Q^2 and ending near the wheel N with a cross-piece Q^3, provided with two toothed shoes corresponding to the toothing of the wheel N. A little cam lever Y serves to hold the shoes on the wheel against the force of a spring.

A plate brake S^1, with adjusting button S^2, serves to put friction on the wheel N, thus damping the vibrations of the needle of the register.

The heavy flywheel V, visible at the right of Fig. 1, co-operates with the regulator in keeping the speed constant.

It may be added that the vertical spindle of gear E^3 is provided with a centrifugal governor R, Fig. 4, formed of two brake shoes U pivoted at U^1, U^1 to the ends of opposite radial arms fixed on a moving plate. These shoes, which are drawn toward each other by springs, are thrown outward by centrifugal force and bear upon the inside surface of the fixed cylindrical box R, thus effecting the automatic brake action of the clockwork, whose movement

*It would seem that O^1 and O^2 must be loose on a short axle rigidly attached to the spindle O which intersects it in the middle at right angles, thus rotating spindle O when the axle turns in its own plane.—*Translator.*

becomes isochronous. The force of the opposing springs is adjusted by little screws acting upon the levers into which the ends of the screws are hooked.

A plate brake Z^1, applied to the wheel E and controlled by the lever Z^2 outside of the box H, enables one to stop or start the clockwork.

In order to use the apparatus, we begin by adjusting the little screws of the governor R, so as to make the needle A move synchronously with the second hand of a watch.

Then the machine that is to be tested is thrown in, and by the button S the position of the friction wheel G is so adjusted that the train of the differential is motionless, the engine shaft establishes at each revolution.

The construction of the apparatus is such that an angular displacement of 1/250 of a turn of the shaft of the machine undergoing test, in relation to the ideal shaft at constant speed represented by the clockwork, is denoted by a 3.3 millimeter displacement of the recording stylet. Now, it is easy to observe on the diagram a bend of a half-millimeter—that is, about one-sixth of the amplitude represented by 1/250 of a revolution. Thus we may, with this instrument, record variations of 1/1,500 of a turn, assuming that the maximum error possible from gear play be small enough. The last was in the experiments as little as 2.2 millimeters, and it is believed that this amount can easily be much reduced by slight modifications in the organs of transmission.

FIG. 4 PLAN OF GOVERNOR

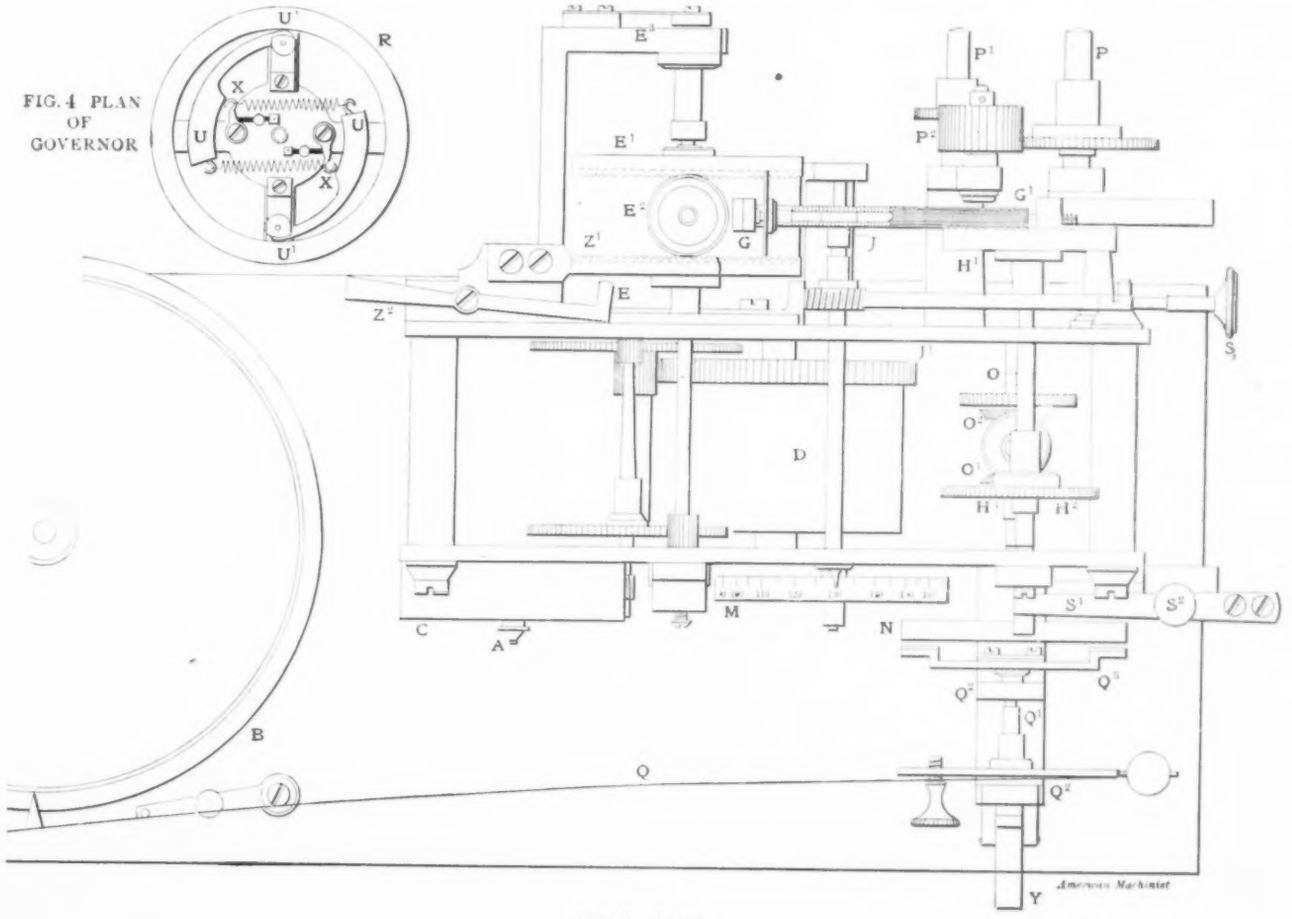


FIG. 3. PLAN.

which may be proved by applying the shoes of the cross-piece Q^3.

The variations of speed are then indicated by a movement in one direction or the other of the mechanism dependent on the differential. Advance causes the needle Q to rise and a backward motion causes it to fall.

To complete the information which the apparatus can supply there has been placed in proximity to the recording cylinder B a second index needle, intended to make known the position of the engine crank, to which the speed variations correspond. For this purpose the second stylet is controlled by a little electro-magnet T, Fig. 1, whose circuit is closed by a contact which

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The deepest hole in the world was bored by the Prussian Government to test for the presence of coal. It is 4,560 feet deep, 11 inches in diameter at the top, and 2 inches at the bottom, where the temperature is 118 degrees Fahr. It cost $25,000 and required 3½ years to bore it.—*Exchange.*

The Tamarack No. 3 shaft in the Lake Superior copper region has just attained a vertical depth of 5,000 feet and the Red Jacket shaft of the Calumet & Hecla is still deeper.

Development of the Star-Point Permutation Lock

Something entirely new in the lock line has recently been invented by Oberlin Smith, who is known to many of our readers as engaged in engineering work of an entirely different character. It occurred to him several years ago, after wondering as to the best way of getting his office safe open in the somewhat dark corner in which it stood, without striking matches to look at the dial and without the severe mental strain due to remembering a tiresome series of backward turns and forward turns and dial readings, meanwhile maintaining perfect serenity and sanity of spirit, that a permutation lock which could be worked in the dark by remembering simply some certain number would be an improvement over anything yet in use.

He thereupon invented and built a real-size working model of what he termed (because of its utility in darkness) the "Erebus" combination lock, the general form of which is shown in Fig. 1, mounted upon a small model door hung between its posts. Externally all that shows is something like an ordinary door-knob about 2 inches in diameter, with a small push-button in the middle, the sides preferably being of an approximately hexagonal form.

This knob answered for pulling open the door or drawer and also for manipulating the bolt as a temporary fastening, without

locking, as in ordinary house-doors. The locking was performed by turning the knob as far as possible to the left and pulling it so as to slide it out a short distance. This set everything at zero ready for another unlocking which was performed by rotating the knob to the right about one-twelfth turn, so that the sides of the hexagon stood approximately vertical, a position within 10 or 15 degrees being near enough and therefore perfectly obtainable in the dark by guess. The button was then pushed by the thumb without removing the fingers from the knob (exactly the same as the button of an electric call-bell) a predetermined number of times, representing the first figure of the combination, which in this case consisted of five digits. Should any of these be ciphers, then the pushes were entirely omitted. Subsequent movements of the knob to the right thru one-sixth of a turn each gave the positions for the other series of pushes of the button, after which the knob was further turned thru a short arc to slide the bolt, which might be spring-driven or otherwise.

This lock worked perfectly as first conceived and constructed, and could be opened with one's eyes blindfolded in half the time that any ordinary safe-lock could be in a good light; and, with the same number of combinations—100,000.

The general principle was the sliding, by the pushing of the button, of five tumblers lying parallel to the axis of the knob—each being successively brought into proper position for a spring-pawl to act upon ratchet-notches therein. Each tumbler contained a changeable pin projecting radially, such pins all being brought into a normal plane when respectively pushed the proper number of steps by the button. When in this plane the barrel controlling the bolt was free to rotate by the final knob motion, while at all other times some one or more of the pins prevented this movement.

It will hardly be of interest to further describe the mechanism of this first lock, which, tho neat in appearance, perfect in action and secure against being picked, had two serious defects. The first of these was the clicking noise made by the spring-pawl, which might enable a listening thief to catch the combination. The second was the expensive construction, owing to much of the work being made by casting, turning and milling. The inventor being too busy with other work to give further attention to the matter and having had plenty of fun out of it, let it lie by until recently, when he again took it up in a totally different form.

In analyzing the subject the three general principles in use as embodied in permutation (combination) locks now in the market were found to be: First, dial locks, in their numerous forms, but all requiring a good light for correct manipulation. Second, push-pin locks, having several sliding pins, certain ones of which (perhaps in certain sequence) are to be pushed in before the knob will release the bolt, and which also must be operated in a proper light, that the numbers may be discerned. Third, click locks, so called, wherein a knob is manipulated by certain pushes and pulls and partial rotations in opposite directions, the clicking sounds purposely produced (and sometimes emphasized by an extra resistance at the points where they occur) being counted and made to agree with the predetermined combination of movements and sounds.

The object the inventor had in view, therefore, was to find a fourth principle, by which a lock could be worked as well in the dark as in the light, and yet would be entirely noiseless. Besides these two conditions, which as far as he knew had never before been attained, a vital consideration was simplicity and cheapness

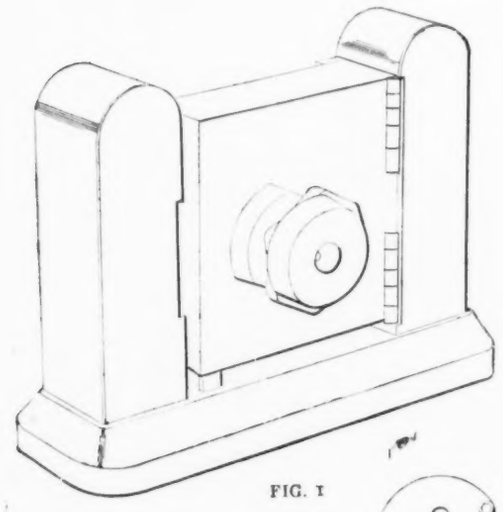


FIG. 1

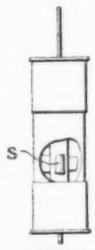


FIG. 2

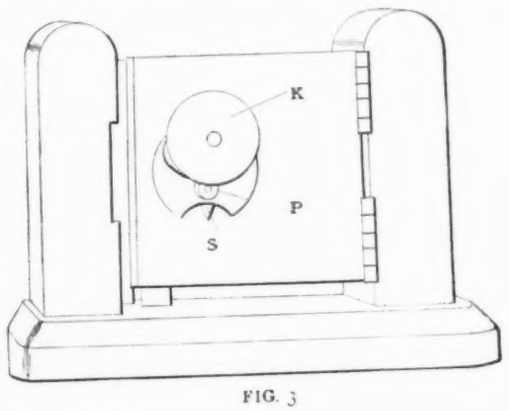


FIG. 3

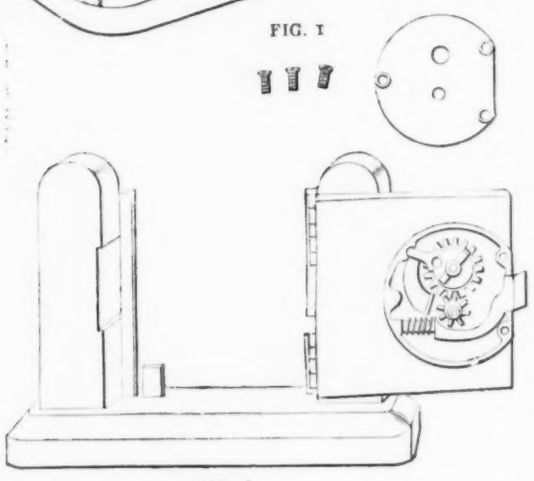


FIG. 4

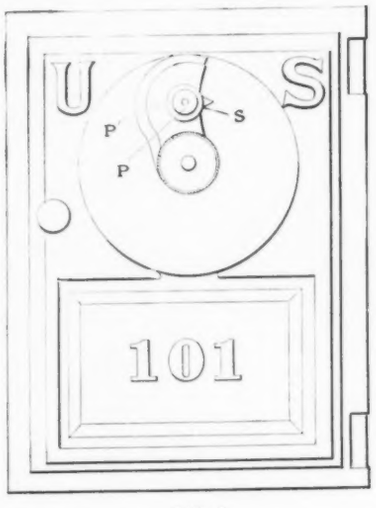


FIG. 5

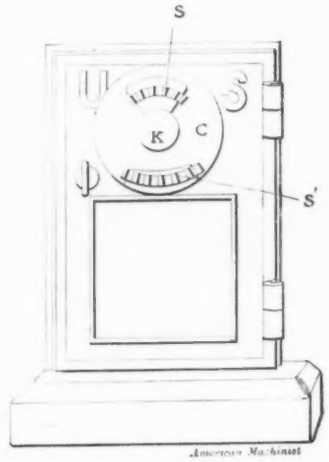
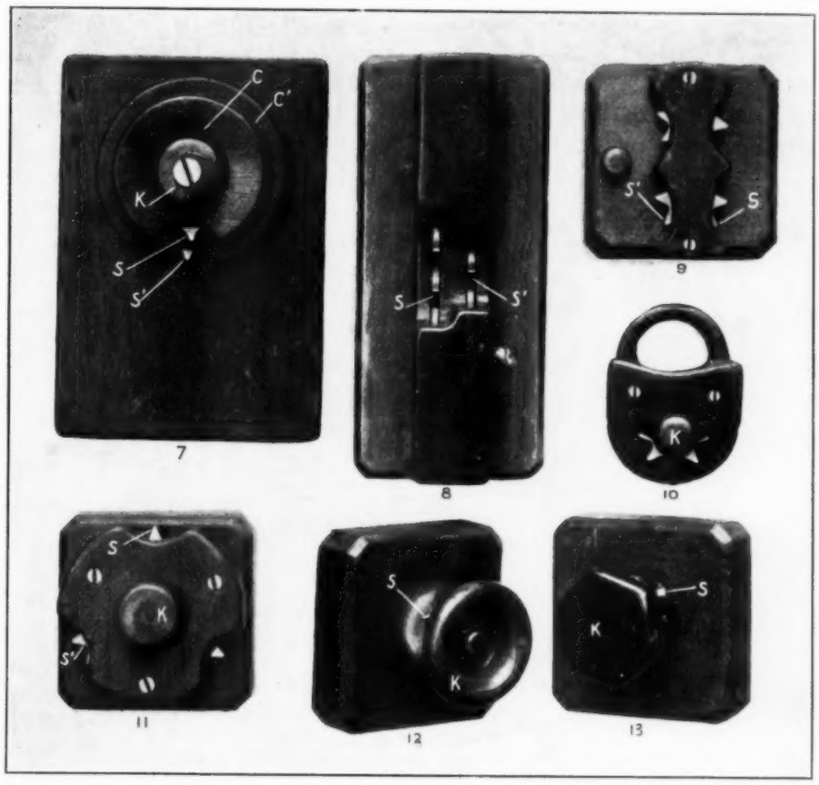


FIG. 6

LOCK EVOLUTION.

of construction, with as many of the parts as possible stamped out in dies or made in turret lathes, without any more expensive operations. This was a problem that his special experience in cheapening sheet-metal work by stamping operations enabled him to solve, so that the new lock now to be described can compete in cost of manufacture with many of the other combination locks and many of the cheaper key-locks.

In the new scheme the thing of vital importance attained was the introduction of rotating tumblers (stamped from flat metal) mounted upon a rod and operated directly by the fingers pushing upon successive projections therefrom, thus getting rid of reciprocating motions, pawls, springs and expensive sliding tumblers.



LOCK EVOLUTION.

A primal conception of this idea is shown in Fig. 2, which was made in a few minutes, by the aid of a pocket knife and the office scissors, hammer and nails, from old cartridge shells, picked up on the golf links. A grave defect in this construcion is that the width of the notch thru which the blades of the rotary member project enables one's fingers to move them at each impulse thru a greater or less angle of rotation, according to the tipping of the finger. The next conception was to make a star-wheel, so thin, and projecting thru a slot so narrow, that the finger could not appreciably enter therein, but would be stopped by the metal surrounding the slot. A further improvement was to make a concaved notch or groove fitting the finger and surrounding the star-slots. The case of the lock in which these grooves were stamped formed a guard for the whole mechanism, allowing but one point of the star to project when a previously moving point should have been brought down flush with the bottom of the groove.

Thus a new system of indexing, governed by touch alone, was evolved, the adaptation in this case being the moving of a lock-tumbler to a number of successive positions at equal angles of rotation from each other, in darkness and in silence. The simplest form of such a lock would be a star-wheel containing some projections or notches at one of its stopping points, which should control and limit the moving of a bolt, and which could be rotated at a number of impulses by one's finger until a releasing position of the bolt was attained. Obviously this series of impulses, which are counted rather than sighted, represent one of the figures in the combination-number of a lock; a duplication of such a simple tumbler device can, of course, be made to represent each of the other figures; thus with ten points to the star, giving ten positions, a lock with two tumblers will have 100 combinations; three tumblers, 1,000, and so forth.

In the earlier models made but one star was used, the tumbler being a separate piece of metal having gear teeth in its edge and meshing with a pinion upon the star-shaft. One of these, adapted for use on lockers, closets, etc., is shown in front view in Fig. 3, with the star-point projecting at S and a push-pin forming the star-shaft, but sliding through it endwise, being shown at P. The knob K was arranged to "scatter" the combination to zero when turned as far as it would go in one direction, and so that it would shoot the bolt if free when turned in the other direction. After the star had been given the required impulses for the first figure of the combination the pin was pushed in to carry the pinion into mesh with the second tumbler, as shown in Fig. 4, which is a back view of the lock with the cover removed.

Another form of this general construction, as adapted to post-office use, is shown in Fig. 5, where the pinion is moved endwise first by the hollow push-pin P' and then by pin P, working inside of it. Thus three tumblers could be successively used, by reason of the pinion having three positions along its axis. This lock was equipped with an automatic "throw-out" which returned all the mechanism to zero position by the action of shutting the door. The latter device it is not worth while to describe, as its construction must be simplified that its cost may be reduced.

In Fig. 6 is shown another post-office lock, where the star members, which ordinarily are in the general form of spur gears, consist of wheels which are attached directly to the tumblers and which have teeth projecting sidewise, thus being somewhat in the general form of bevel gears. This lock is extremely simple, but if the stopping points for the "stars" $S\,S'$ were in a fixed position would have only 100 combinations, there being only ten positions for each star. A plan was adopted, however, of attaching the stopping points to a cap C which formed the front of the lock, and which could be turned, under considerable friction, one-twentieth of a rotation. This gave twenty stopping points to each star and consequently 400 combinations. The cap and both stars were held in position by the shaft of the knob K in the center, which operated the bolt in one direction and the stars to zero in the other. A nut and flat brake-spring on the rear of this shaft controlled the friction of both stars and of the cap. It also served to assemble the whole device without further fastening. The tumblers were flat-notched disks which could be set around to different positions in relation to the stars, for changing the combination. This lock, tho cheap and simple, has perhaps too few changes to be extensively used.

At this stage of the invention, certain wooden models were made, showing different applications of the star-point principle. They were not, however finished up as complete locks. In all cases S represents a star, K a knob and C an adjustable cap, etc.

One of these is shown in Fig. 7, where the general principle is the same as in Fig. 6, but where flat stars S and S' are used. These have an unusually large number of teeth, the capacity of which is doubled, as in the former case, by using the differential principle of setting the caps C and C' to either of two positions about their com-

mon axis, the angle between which represents half the pitch angle of the star.

In Fig. 8 is shown a sliding rather than rotating style of tumbler S and S', an analogue of which is a rack, rather than a spur or bevel gear. Obviously an extremely simple lock could by this means be made, the release of the bolt being allowed by a notch in the back of each of these flat, rack-like slides, when their teeth reach certain relative positions. Such construction, however, would usually take too much room, and not be practical for many changes. The capacity, as regards number of positions, can be doubled and the total number of combinations quadrupled in a lock of this kind by another differential principle, where the finger-groove allows intermediate or half-way positions for the star-points when the finger is moved upward instead of downward. In other words, the notches measure by two-and-one-half times the pitch of the teeth, rather than by two times, as is ordinarily the case. The "up" or the "down" of course form part of the remembered combination—as well as the figures.

In Fig. 9 is shown another differential principle for doubling the capacity of each star. Here the teeth, when pulled down on the right side below the bottom of the finger groove, as at S, are (by reason of the shape of the groove) left in half-way position on the left side, as at S'. Thus twenty positions can be obtained with a ten-toothed star, the "right" and the "left" of it being remembered. The same thing is true of the other stars shown, or of as many more as might be placed in a row. In all these constructions the total number of combinations would of course be the number of stopping positions raised to the square, cube or other power, the exponent of which power was the number of stars employed.

In Fig. 10 is shown a possible padlock the rear side of which is the same as the front; thus with the two ten-point stars, using the differential principle shown in Fig. 9, 400 combinations could be obtained.

In Fig. 11 a construction is shown with three stars arranged in a triangle, each with a separate axis. Obviously a lock could thus be made (adjustably attaching the tumblers to the rear of the stars) with three "stumps" upon the bolt arranged to engage with the respective tumbler notches.

In Fig. 12 is shown a knob which contains a star entirely encased within it and underneath the shank thereof, the changes to different tumblers being made by a push-pin or -pins, as in case of Figs. 3 and 5.

In Fig. 13 is shown a star imbedded in a knob and having its axis at right angles to the knob axis, but not in the same plane. This is an old conception of the inventor's, where the motions of the star were intended to carry sliding tumblers in place of the clicking push-button employed in the original device, as in Fig. 1. This idea was, however, abandoned for practical use.

The next step in the evolution of this lock, and one that has seemed to bring it at once within the lines of practical economical manufacture, was the arranging of several flat stars upon a common axis parallel to the front of the case, the one working point of each of them projecting thru a slot therein in a position pointing toward the operator. The first model made upon this principle was a perfectly working post-office-box lock, shown in front view in Fig. 14, together with other views in Figs. 15 to 18 inclusive. An exact detailed description of this lock would be out of place here, as it is not yet ready for the market, the automatic scattering device and possibly some other details being capable of further simplification and cheapening in cost. It will be noticed that in this lock there is room to set the stars so far apart that all four fingers of the operator can be used at once, thus playing chords as it were, and quickening the work of opening after getting a little accustomed to some certain combination. That this can be done very rapidly is instanced by the inventor, with his eyes tight shut, having opened it and closed it eighteen times in a minute, the closing of the door each time setting all the stars back to zero. Thus it was ready for the next manipulation of the stars, according to the proper numbers.

This scattering of the combination is obligatory for locks in post offices owned by the government, and is desirable also for post offices where the buildings and fittings are private property. This is because box-holders are careless, their efficiency in carefulness being estimated at about 90 per cent. only, as regards scattering the numbers so that would-be thieves shall not gather them up and learn the combination.

In Figs. 19 to 22 inclusive is shown the next stage of development in the star-point lock. It is here vastly simplified in construction, and consequently much reduced in cost. This is accomplished by making the bolt B itself the shaft or axis upon which the stars rotate, thus giving it a double function. It slides in a case C, which may be varied in form to suit its application to any particular kind of door, etc. Pressed into a groove in B is a feather F, which in the open position of the bolt prevents the stars from turning by the feather having entered the key-seats therein. When the bolt is shot to the left, fastening the door, by means of the knob K, the stars can turn in the notches shown in the feather, but in such position the bolt itself cannot be moved endwise and thus withdrawn from the doorpost by reason of every star interfering, unless these should happen to be in a position with the key-seats at the top, so that the feather can travel freely thru all of them.

Mounted upon the bolt are a number of washers W having a slot thru one side in which the feather slides and which prevents them from rotating, thus performing a double function. These washers have projecting from them a lug l. Their func-

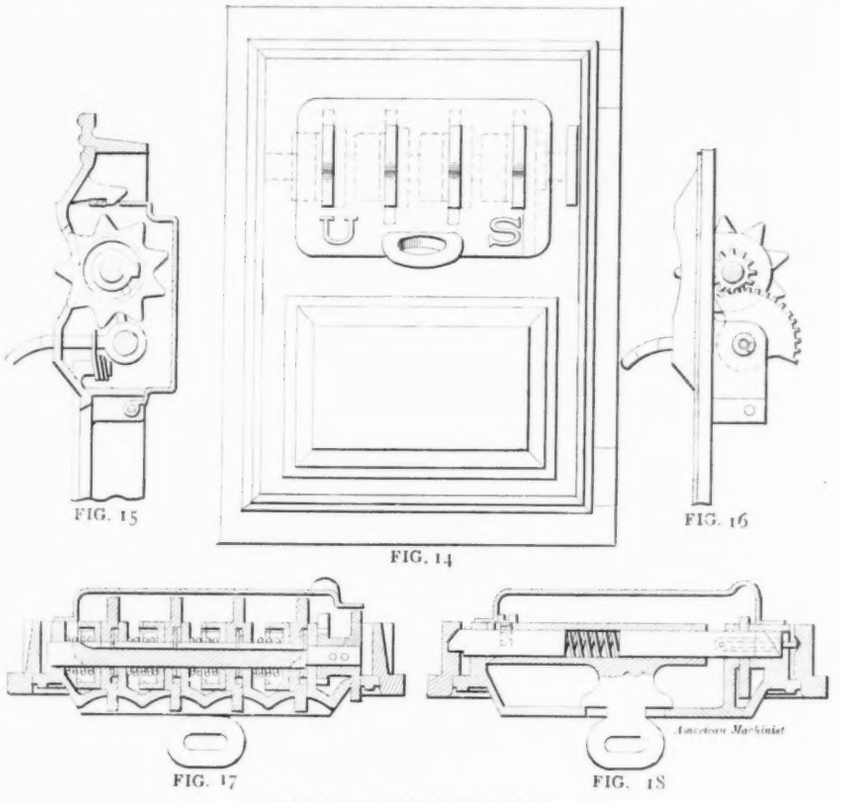


FIG. 15 FIG. 14 FIG. 16

FIG. 17 FIG. 18

STAR POINT POST-OFFICE LOCK.

tions are to separate the stars *S* and also to form friction plates between them so that the moving of one will not tend to move another. A third function is to stop the stars from rotating too far in either direction by means of an adjustable lug projecting from them, striking the lug *l* from either side when turned downward or upward (counting at the front) with a total angular motion of nine-tenths of a rotation.

Obviously, if the star-lug were permanent upon it, there could be no changes of combination, but the lock would work properly as originally set. The desired change is accomplished by mounting upon washer *W* a ring *R* which rotates thereupon, and which becomes in effect a part of the star, moving therewith. One of its lugs *r* (both are alike) engages in one of the numbered notches in the side of the star. This ring is made of elastic metal and is slotted nearly all the way around so that it can be sprung together, but will return to its original position. A change of combination can therefore be made by the point of a knife or hair-pin or other small tool inserted at the back of the lock, to spring the ring together while turning the star so that the lug may snap into another notch.

The other lug *r'* forms a dead-stop by striking the stop *l* upon the washer when rotated in either direction.

At *P* is shown a plate mounted upon the bolt at the end of the row of stars and washers, which is of elastic sheet metal, slightly bent so as to act as a brake spring, and which causes a proper resistance in the stars when handled by the fingers. Without this they would fly around too far by their own momentum. In this construction one such plate answers for all of them whatever may be the number. In some cases a resistance plate, shown separately at *P'* but omitted in the main drawings, is so mounted upon the case as to straddle the stem of the knob *K* and give a little resistance to the action of the bolt when moving it to the right and tending to keep it home all the way to the left, thus allowing the stars to rotate freely in the notches of *F*. The plate is of elastic metal so that it will spring slightly apart as the knob stem passes thru the narrowest part of its slot. This is usually necessary when the bolt is used vertically, as in the case of drawers, and is an advantage in any case.

The star itself is made from flat sheet metal with ten teeth (points), a central round hole, a keyseat and nine shallow notches around it, all varying in depth. These notches are a common device and prevent the picking of a lock by bringing pressure upon the knob while tumblers are moved against whatever is to enter them. In this case it would be the stars revolving against the projecting parts of the feather, and were the stars smooth the key-seat could easily be found. Near the outer extremity of these "false notches," as they are termed, are deeper depressions in which the lug *r* of the ring *R* engages. In stamping the stars the key-seat is put in afterwards at random, and may happen to be coincident with any one of the varying notches. Thus with the same tools there are really ten kinds of stars, as regards the location of the different depths of false notches. In a large batch of four-star locks there may therefore be (by the law of chances) 10,000 different kinds of locks, all made with the same tools by the same kinds of operations, without either the workmen who made them, the manufacturer who sold them or the users who bought them knowing exactly what kind of a lock any particular one is. This random quality is a great disadvantage to a would-be picker of the lock, even tho he is thoroughly acquainted with its construction; and yet it adds nothing whatever to cost and detracts nothing from the quickness of construction.

The next evolutionary stage in the history of this lock was to put its manufacture in the hands of expert makers and sellers, with a view of getting it properly before the public. Such were found in the personnel of the Corbin Cabinet Lock Company, of New Britain, Conn., who have commenced to put it upon the market and who have already equipped with it the lockers of the new gymnasium in one of our larger universities. In doing this some slight modifications were made in the form of the case, but the working parts were practically the same as in the original model made by the inventor, shown in the pictures above, and which was never altered after its first conception.

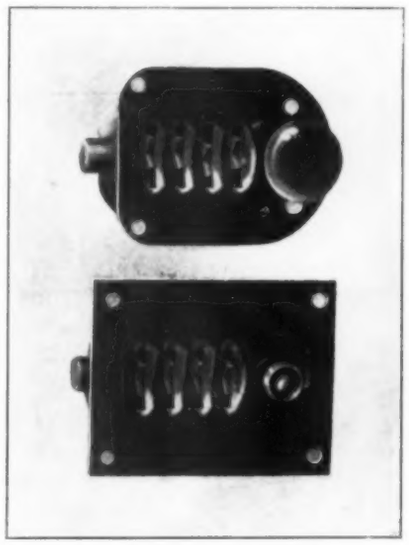


FIG. 23. FOUR-STAR LOCKS.

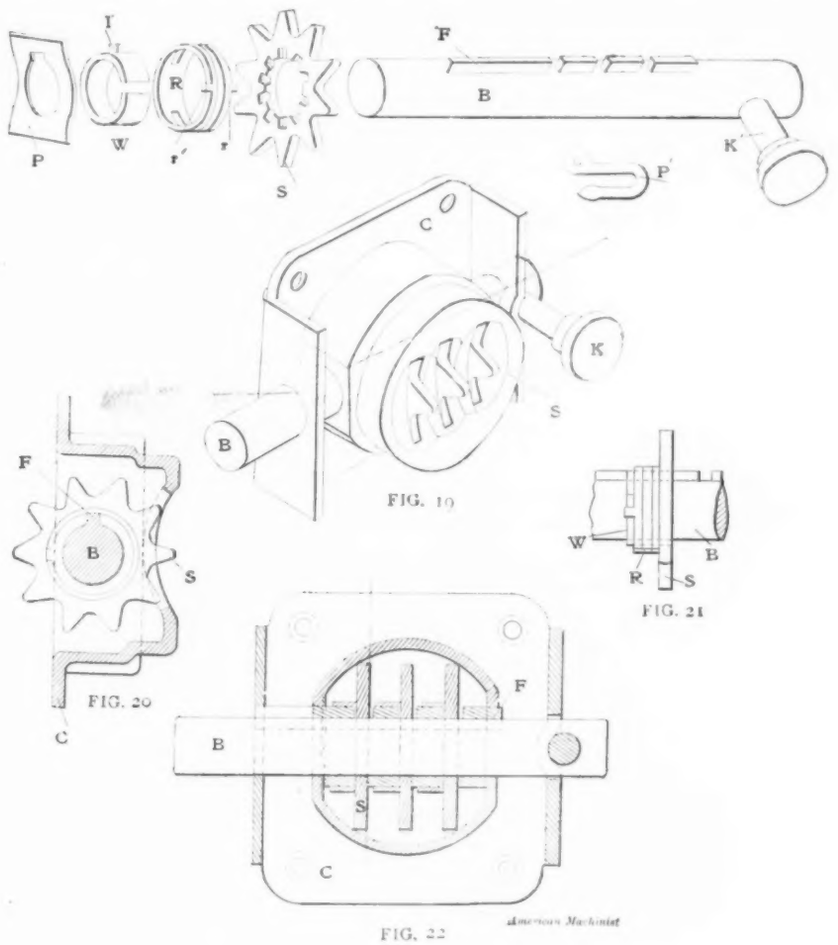


FIG. 19. FIG. 21. FIG. 20. FIG. 22.

CONSTRUCTION OF THREE-STAR LOCK.

In Fig. 23 are shown two of the newly manufactured four-star locks, the upper one being a drawer lock and therefore mounted vertically when in place, with the knob at the bottom; and in Fig. 24 is one of the locks with the hand of the operator pulling down the stars with her forefinger to their various relative positions for opening the door. In Fig. 25 the hand is shown pushing them upward, several at a time, with the thumb, thus turning them to zero (when the door is in locked position) that they may be ready for pulling down again to carry through the combination.

In Fig. 26 is shown a three-star lock attached to a drawer, in vertical position. This has just been pulled open, but the operator in this case is showing the method of unlocking by pulling the star-point toward the left instead of downward, as in a lock horizontally placed.

The only difference between the closet and the drawer locks is that the latter usually have a smaller escutcheon, perhaps of a different shape, and a larger knob which may be used for pulling open the drawer. It is expected that these latter will soon be manufactured also, both in the three-star and four-star forms.

It is obvious that if the fronts of the stars are all pushed upward as far as they will go, to the zero point, each must be pulled down and stopped after giving it the predetermined number of impulses embodied in the particular combination to which the lock is set. After this the bolt will freely slide, but not at any other time. Thus if the combination is 4321, four points of the first star (on the left) must be successively pulled down. The next star will be pulled three points, the next two and the last one. If the combination were 1000, then the first star would be pulled once, the others remaining dormant. If the combination were 11, then the last two stars would each be pulled down one point, etc., etc. As a matter of course, a one-star lock would give ten combinations; a two-star, 100; a three-star, 1,000; a four-star, 10,000, etc. By making the case a little longer and using a few additional units of each kind, a safe-lock with six stars may be made, having 1,000,000 combinations.

Among the strong points of this invention and construction is the small number of kinds of pieces required, with a chance of using many of them in duplicate, to suit combinations of various magnitudes. Another is the cheapness in design of the various pieces, allowing almost everything to be made either with presses and dies or with turret lathes, thus putting the lock in competition with other cheap combination locks now on the market, while giving a much larger number of changes. It will be noticed that in the operating parts of the lock shown there are no springs whatever. A modification in the construction, however, will allow the use of a spring-bolt if desired.

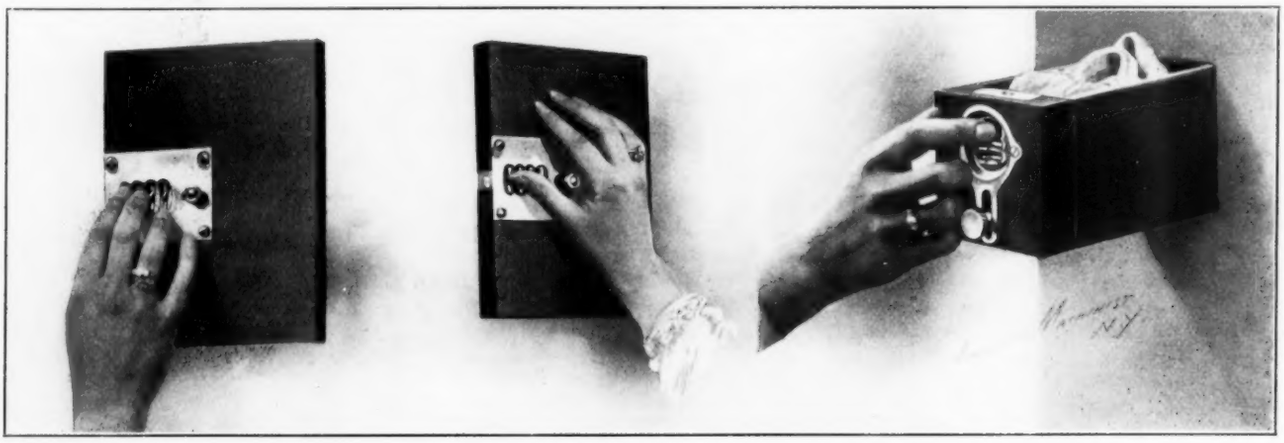


FIG. 24. FIG. 25. FIG. 26.

OPERATING THE STAR-POINT LOCK.

It is obvious from the foregoing description that this lock makes no noise whatever when manipulated, and can be operated in the dark as well as in the light.

Electrically Driven Planer with Speed Changing Countershaft.

The motor-driven planer illustrated herewith and embodying some interesting features, especially in connection with the driving mechanism, will plane 96 inches wide by 72 inches high, and in length up to 24 feet. It is fitted with two heads on the crossrail, these having automatic and independent feeds in all directions, and has also one side head on the front up-

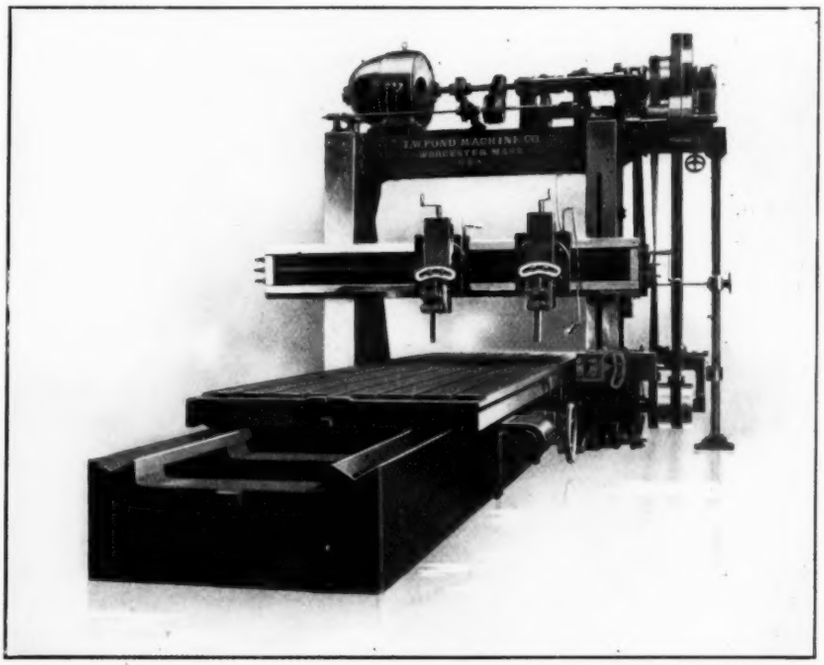


FIG. 1. ELECTRICALLY DRIVEN PLANER WITH SPEED-CHANGING COUNTERSHAFT.

right. The feed in the heads is 26 inches, and the crossrail is 22 inches deep. The planer has five shafts of large diameter in the running works, and is powerfully geared, the gearing, which is of steel

throughout, having a ratio of 48 to 1, while the ratio of belt speed to table speed is 154 to 1. The rack gear has a 10-inch face, 1½-inch diametral pitch, and the pulley shaft makes 19.6 revolutions to 1-foot travel of the table.

inches, and the angle 120 degrees. The table is 80 inches wide, 8 inches deep and 3 inches thick on the top. The housings are of box form, double web, and braced on the inside by cross ties; and they are designed as represented, to support on the

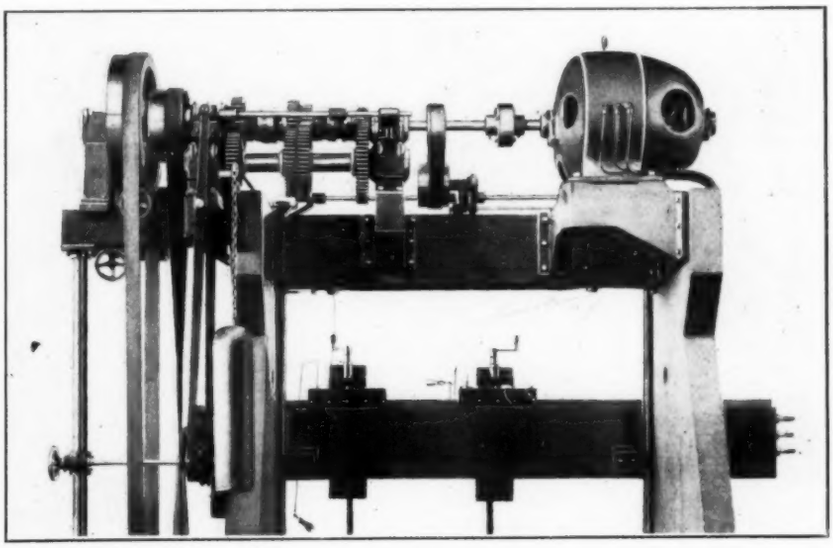


FIG. 2. REAR VIEW, SHOWING DRIVING MECHANISM.

and using power only when feeding; and the cam belt shifting device with which it is equipped operates from either side of the machine.

The arrangement of the motor drive is shown clearly in Figs. 2 and 3, and it will be seen that the countershaft is coupled direct to the motor shaft by a flanged coupling, and the whole mechanism is supported by brackets bolted to the arch and uprights, additional support for the right-hand bracket being secured by a 3½-inch iron column under the extreme outer end of the bracket. The shafts are 2¾ inches diameter and run in self-oiling, bronze bearings, enclosed in cap boxes insuring against accumulation of dirt. Under the driving pulleys there is a belt-tightener acting upon the slack side of the belts. Thru the arrangement of gearing shown, by simply turning a hand-wheel which is at the side of the round supporting column and within reach of the operator, four different rates of speed are applied to the table, these speeds being respectively 15, 20, 26 and 35 feet per minute, with a constant return speed of 70 feet per minute. The changes of speed are regulated by a dial on the hand-wheel,

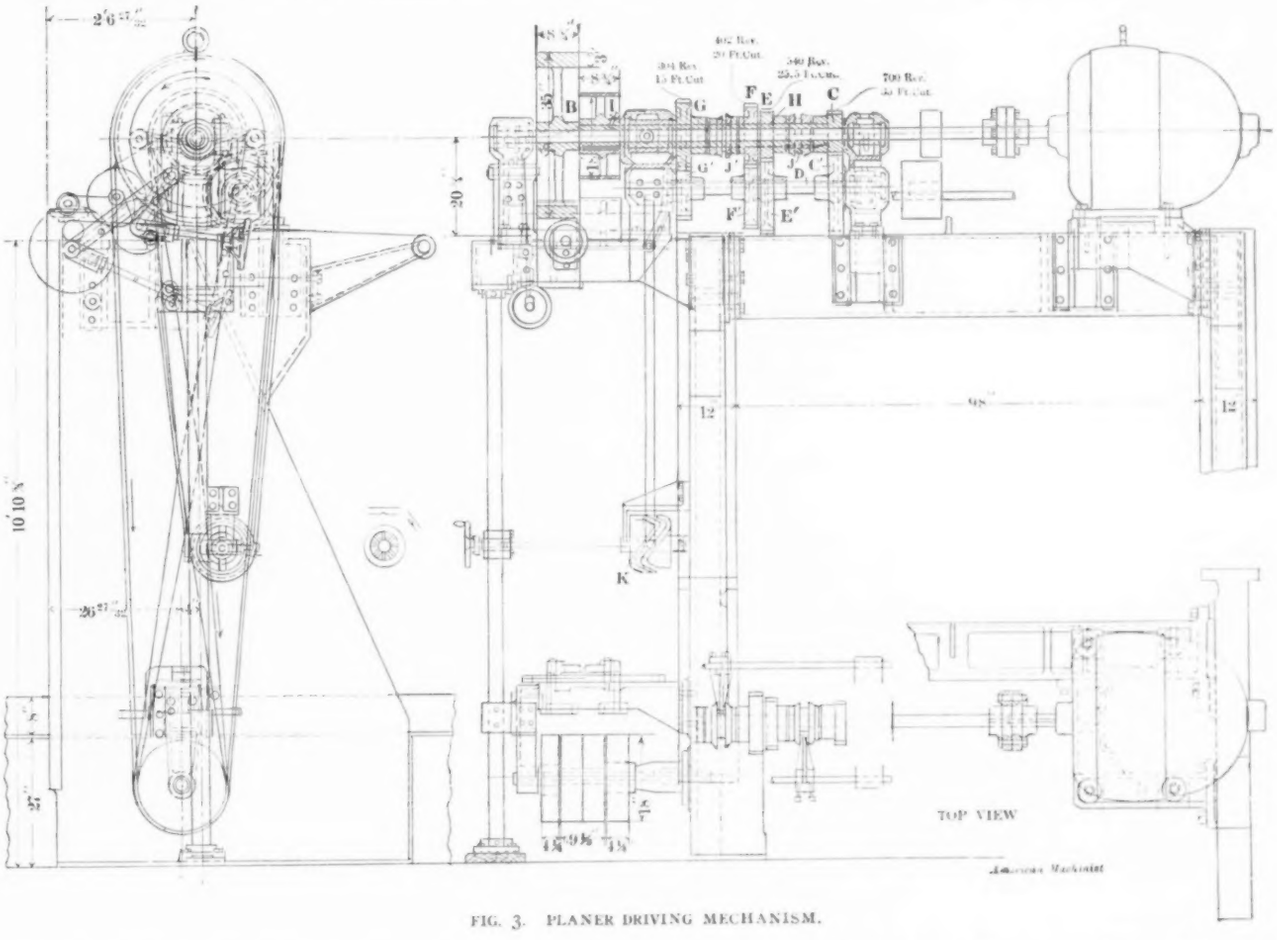


FIG. 3. PLANER DRIVING MECHANISM.

The bed, which is well braced at short intervals, as indicated in Fig. 1, by substantial box girts, is 27 inches deep, and the distance between the "V's" is 54 inches. The width of the "V's" is 9

top the speed-changing mechanism and motor. The planer is entirely self-contained, as the gearing in all parts is above the bottom line of the bed. It has improved feed boxes, giving a positive feed,

the latter being mounted on a shaft carrying a cam drum which operates two levers for shifting the gear-controlling clutches overhead. Each lever thus controls two speeds, and the cam and levers are so ar-

ranged that one of the levers must remain stationary while the other is moved to shift its clutch. Hence there is no possibility of both clutches being accidentally engaged at the same time.

Referring to Fig. 3, which shows the countershaft at *A*, it will be observed that the balance wheel *B*, which is also the return-belt pulley, and gear *C* are keyed to shaft *A*. Gear *C* meshes into gear *C'* on shaft *D*, *E* meshes into *E'*, *F* with *F'*, and *G* with *G'*. Running on shaft *A* is the cast-iron sleeve *H*, on which is keyed the cutting pulley *I*; the gears *E*, *F*, *G* running on the sleeve *H* are held in place by steel collars. Clutches *J* and *J'* are splined, and slide on keys set in sleeve *H*. When the shaft *A* turns, the shaft *D* and all gears rotate, but sleeve *H* remains stationary until one of the clutches is thrown in. Throwing the clutch *J* into gear *C* causes the sleeve *H*, on which is keyed driving pulley *I*, to rotate and give to the planer a cutting speed of 35 feet per minute, with 70 feet per minute return. Throwing the clutch into gear *E* drives sleeve *H* by the gears *C*, *C'* and *E'*, *E* giving a cutting speed of 26 feet per minute. Throwing clutch *J'* into gear *F* gives, thru gears *C*, *C'* and *F'*, *F*, a 20-foot cutting speed; and when clutch *J'* is connected with gear *G* a cutting speed of 15 feet per minute is obtained. The sleeve *H* is 50 inches long and 4⅝ inches diameter; it runs in a self-oiling bearing 9 inches long, and has a 12-inch bearing at each end on shaft *A*, the oil feeding from the self-oiling bearing to the chamber of the sleeve, and then thru the oil grooves in each end of the sleeve bearing. It is lubricated also thru compression oiling cups on the loose gears *E*, *F* and *G*.

The drawing shows the levers in the central position relative to the cam drum *K*, and with both clutches out. As the hand-wheel on the cam shaft is turned to the different notches, as shown on the dial, the levers will move accordingly, following the direction of the cam slot. The latter is 12 inches outside diameter, with a 1-inch slot ⅝ inch deep, into which fit the rolls carried by the levers. This slot is cut parallel with the edge of the drum for one-half of the circumference, so as to have one lever always in a vertical position.

The motor used on this planer is a Crocker-Wheeler 35 horse-power, 230 volts, with a speed range from 100 to 700 turns per minute, so that by the various motor speeds and the geared mechanism the machine is adapted to the widest possible range of work. The cutting speeds given are obtained with the motor running at 700 turns per minute.

This planer was built by the L. W. Pond Machine & Foundry Company, of Worcester, Mass., for the Crocker-Wheeler Company, Ampere, N. J.

The Walter Current Motor.

We have received some inquiries regarding a current water motor for which great claims are made, and a competent engineer representing the AMERICAN MACHINIST has investigated and writes us substantially as follows:

"An article appeared in the *Washington Post* for July 30, simultaneously, as I am informed, with a number of similar articles in newspapers of other cities, stating that a company had been formed by a number of influential Washington men, including several members and ex-members of Congress, with $15,000,000 capital, to exploit a new water motor, the invention of William H. Walter, of Pontiac, Mich.

"Mr. Walter, who is a veteran of the civil war, and who, by the way, is about to undergo an operation for the removal of a portion of a shell which he has carried in his body for forty years, states that he has spent his whole time practically since the war in developing his inventions. He has already received three patents on his water motor, and says he has refused $75,000 for one of them.

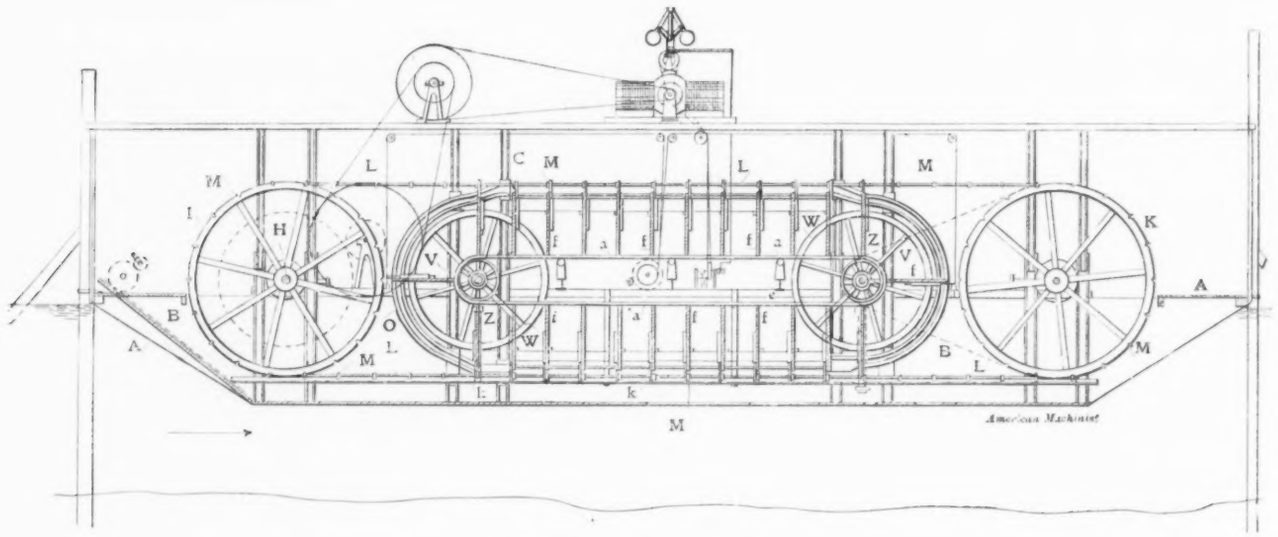
"The facts are about as stated in the newspaper article referred, altho, as is almost always the case where technical matters are involved, the results expected to be obtained are painted in too glowing colors.

"The invention, to exploit which the company has been formed, is, as shown by the patents and by the model which was built and experimented with in the Potomac River, not greatly different, except in detail, from any other type of current motor. Expressed in its broadest terms, it consists of a paddle wheel, supported on a float or between scows, so as to be partially immersed in a running stream, the power being taken off by gearing of some kind to run a dynamo or other machine. This is, as everybody knows, one of the oldest forms of motors.

"Instead of a simple paddle-wheel, however, the paddles or blades are pivotally carried by endless belts or chains, their free ends being held by buttons or projections carried by other belts or chains—cables is the generic term used in the patents—passing around the first ones.

"The accompanying drawing, reproduced from one of Mr. Walter's patents, dated June 3, 1902, serves to show the idea, although the inventor has devised several modified forms.

"In this drawing *A* is a boat or a float, which is provided with a well-way or channel *B*, of which there may be several, arranged side by side or tandem, and *a* is the cable to which the blades *f* are pivoted at one end. This cable, or rather cables, since there are two arranged side by side, runs on sprocket-wheels *Z*, on the shafts of which are also mounted larger wheels *W*. The free ends of the blades *f* are engaged by buttons *M* ar-



THE WALTER CURRENT MOTOR.

ranged at regular intervals on cables *L* running around large wheels *I* at each end of the channel.

"In order to engage and disengage the free ends of the blades *f* at each end of their travel, cam runways *O* are provided, which engage means connected to a slide on each blade to withdraw or project the forks *k* which engage the buttons *M*. The object of the wheels *W* is to hold the paddles in proper separated position as they travel around the curved ends of their paths.

"Hinged doors or flaps are provided on the paddles, to lessen their resistance to the water as they pass into and out of the same.

"It will be unnecessary to go into further detail. As will be seen from the drawing, power is taken off from the shaft *H* to drive a dynamo.

"The only means described for regulating the speed of the motor is by raising or lowering the float by letting water into or pumping it out.

"It will be evident to all engineers, from this description, that there is here no such wonderful and revolutionary power generator as the newspaper article implies, tho a good many untechnical people here believe in it, just as thousands like them have believed in other things that had little or no value.

"A model was built and installed in the Potomac River, about ten miles above Washington, near Cabin John Bridge, but it is now entirely dismantled and apparently a complete wreck. Parties interested talk of tests having been made by mechanical and electrical experts, with wonderful results, but say the results are not yet ready for publication. If when published they are very flattering, it will be interesting to note whether or not they are signed by a real mechanical or electrical expert.

"The main feature of novelty in the apparatus is the means for inserting paddles into and withdrawing them from the stream and of supporting the same in a vertical position on the forward and return travel. Altho this may be an improvement over a paddle-wheel having feathering blades, it is difficult to see how the amount of power obtained can be materially greater, altho I hope I am not doing the inventor an injustice in so stating."

In speaking of a decision of an American court, our esteemed contemporary, *Engineering*, uses the expression "restraint of trade and of the liberty of the *subject*." There are no subjects in America—Americans are *citizens*—and if *Engineering* wishes to keep on the good side of us it will carefully remember that fact.

Mr. Dugald Clerk recently stated that in England there had been produced, altogether, nearly 100,000 internal combustion engines of an average of 20 horse-power.

Letters From Practical Men.

Another Way of Cutting Self-Hardening Steel.

Editor American Machinist:

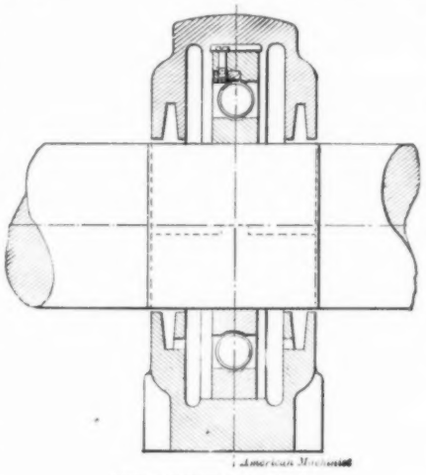
At page 970 an article appeared on cutting self-hardening steel with a thin steel disk. It would be interesting to know the time required for cutting such steel as described.

In the shops of the Cincinnati Milling Machine Company, where a great deal of high-speed steel is cut, an emery wheel 8 inches diameter, 1-16 inch thick, is used in their regular universal cutter grinder, and it is astonishing to witness that it requires only 10 seconds to cut thru a 5-16 inch square piece of self-hardening steel. The wheel runs 3,600 R. P. M., and will wear off approximately 1-32 inch in diameter for each piece of steel cut. Steel of larger dimensions, such as ½ inch or ¾ inch square, is nicked only 1-16 or ⅛ inch deep on four sides and broken off by the blow of a hammer, same as in the Armstrong Bros. Tool Company's process. It is essential in this process that the steel be firmly held and steadily fed to the wheel, this being accomplished by the use of the machine referred to. R. R.

Preventing Oil Drip and Leakage With Ball Bearings.

Editor American Machinist:

In connection with Mr. Hereford Berry's very interesting article on "Oil Dripping and Oil Slinging," at page 1053, I beg



PREVENTING OIL DRIP.

to be allowed a few remarks in extending the subject. The illustration shows a typical Hess-Bright ball bearing solid pillow block. The box is closed in at each end by a plate formed into two lips by an annular cored groove. This groove contains no packing. The lips are bored out 1-64 inch larger than the shaft. Experience with thousands of these arrangements has proven that under all speeds, including such as obtain in steam turbines, all outward creeping and leakage of oil and also entrance of dust and grit is prevented. A slight amount of oil will pass the inner lip to be drained from the groove by a hole at the bottom back into the oil reservoir, the proper oil level being slightly below the drain holes. The arrangement is simplicity itself and possesses peculiar advantages in not requiring the provision of drip collars, grooves or rings such as are ordinarily cut into or attached to the shaft. Unfortunately, this simple device cannot be employed with plain journals, as the natural wear of such journals soon enlarges the space between the lips and the shaft, so much so as to permit the oil to get out. Its use is therefore restricted to bearings that have no appreciable wear, such as these ball bearings.

The action is probably analogous to that of the well-known grooving for making pistons water tight, in which the "wire drawing" and eddy interference of the liquid that finds its way between the piston and cylinder results in preventing leakage. In such work the pressure is high and therefore a number of grooves must be employed; in bearings as here arranged the pressure is so low that "wire drawing" alone is sufficient. HENRY HESS.

A Grinder's Troubles.

Editor American Machinist:

I was pleased to find an explanation of my troubles with Corliss valves at page 1000 by such an authority as Mr. Norton. Really, I should have thought of this simple explanation myself. He evidently imagines we grind nothing but valves on this machine or, in other words, that all the work produced by it is .001 inch small in the center, and therefore jumps at the conclusion that the "machine is not straight" and suggests that it should be made over again in this respect. Would it not be too bad to fix the machine so it would grind valves straight and then find that all steel shafts and solid pieces of gray iron (which amounts to nine-tenths of machine's work) would be exactly .001 inch larger in the center than at the ends? Why does it grind .001 inch small regardless of length? Why does it grind everything straight except valves? In *re* grinding work "too large" for machine at page 937, this should read "too long" for machine.

Amherst, N. S. C. W. HENRY.

Editor American Machinist:

Mr. Henry seems disposed to see mystery in his grinding machine. Without going further into the discussion I will ask him to find out exactly what the facts are, and to test his machine as follows: Place a 3-inch machine-steel bar on the centers and the full length of his machine, see that the center holes are round, rotate the bar 20 turns per minute; use as soft a wheel as possible—No. 60, grade L, may be too hard or it may answer. Run the wheel 6,000 feet per minute and grind the bar without steady rests; make sure that both ends are exactly the same diameter, then measure each 3 inches over the entire length and be sure that the bar is round in order not to be deceived about the ma-

chine, for the machine is not responsible for a lack of roundness. When grinding use a large supply of water and be sure that the wheel takes a uniform cut when passing over the last time. When you have measured carefully, please make a diagram of what you find and give it to the readers and tell us which end of the test bar was toward the headstock. When we get this report it will be better to argue than now. Please be very careful when grinding to observe the directions, for if one link is changed all will be off. If the work rotates faster than about 20 turns or the wheel is harder or finer than 60 L and runs less or more than about 6,000 feet, you cannot be sure that you know exactly what the facts are about the machine. Do not use gray iron to test a machine. A bar of less weight than that of about 3 inches will not find all the facts. Use a test bar as heavy or heavier than the valves of which you complain. In fact, the test bar should be the maximum of weight for your machine in order to discover all the facts.

I assume that your machine is one where the work traverses past the wheel and that you use at least a ¾-inch stream of water when grinding all work.

Whether I have guessed correctly or not as to the kind of machine, please make the test carefully and report as to the style of machine when sending diagram.

C. H. Norton.

The Design of Ball Bearings.

Editor American Machinist:

In the American Machinist, at page 1001, I notice a communication regarding the design of ball bearings, and should like to submit a few words in this connection.

Undoubtedly a four-point ball bearing such as that shown and with two rows of balls proportioned as suggested would give very satisfactory results provided the relation of the various surfaces were mathematically correct, and provided further that the journals for the shaft had no wear. It is very evident that any sidewise wear, such as necessarily occurs with ordinary journals, would cause a relative shifting of one plate against the other and that such shifting would at once destroy the proper relation of the surfaces. It is also evident that to produce bearings in which there are no less than eight different surfaces, all of which must be correctly located with reference to their distance to the center and also at the correct angle, requires a degree of workmanship that while not impossible to a comparatively few men, yet is entirely out of the question as a commercial proposition or even as a possibility for more than a very few establishments.

If these conditions of accuracy are not attained in the first place and maintained in use, a bearing of this type will not result in a distribution of the load over the two rows of balls or even over all of the balls in one row and will, besides that, result in decidedly improper rolling action of the balls; that, of course, means grinding and a more or less rapid deterioration under anything like heavy loads.

Probably more exhaustive research and practical experimentation in this line has been done by Professor Stribeck than by anyone else, and he has come to the conclusion that ball bearings having only two points of contact and single rows of balls will give better results than any other possible type and besides that possess the advantage that variations in form, such as are inseparable from practical machine-shop operations and also variations in the relative center distances due to wear of the radial bearings will have no appreciable effect on their running qualities, their wear or their frictional resistance. In order to have a high loading capacity, the races should be grooved to a radius somewhat larger than that of the balls; races in that form support the material that is in actual contact and subject to stress from the sides and so prevent flaking, and therefore greatly increase the carrying capacity and life.

It may be laid down as practically axiomatic that ball bearings should consist of but a single row of balls and the number and diameter of the balls should be properly chosen in accordance with the load and condition of shock and speed of the bearing. That of course requires a very decidedly extensive experience, such as can be obtained only by long and costly experimental work backed up by practical use under the most varied conditions.

Henry Hess.

A Water Diviner and His Work.

Editor American Machinist:

At page 964 I notice an article on "A Water Diviner and His Work" which greatly interests me, because it narrates substantially my own experience of many years. I became interested in the subject at an early period of my boyhood when we were about to dig a well at an elevation sufficient to supply the homestead and highway with living spring water. As a preliminary we secured the services of several operators of "water witchery," each privately and separately, with remarkable uniformity of results. I then found that the stick would turn in my own hands even with one branch in the hands of another "non-gifted" person, twisting the bark off or breaking the branch held by the other. I have since found many veins in the same manner, and wells sunk in each case have vindicated the reality of the "gift," never failing to find the running water within a few inches of the point and depth predicted.

Now, as an inquiring boy I sought an explanation other than witchery or a personal and mysterious "gift"; for, thought I, it must have a rational scientific reason at bottom if I could only find it. So I began my search, and thought I found it. Of course I had limited means for investigation in those days—thirty years ago—but my first thought was that it must be an electrical phenomenon and on that assumption I proceeded. I found that only *running* water could be so found, ordinarily, and my old "Philosophy" (Olmstead's, I think) informed me that water percolating thru the soil generates electricity—hence I said that the ground over a vein must be overcharged with electricity beyond the earth's normal supply and therefore in effect the spot must be a storage battery waiting for connection. My next step was to find out if I were a good "conductor" and visited an old-fashioned lightning-rod agent and tried his battery, with the surprising result that I was so good a conductor as to take the entire power of the machine without unpleasant sensations. He said I'd "make a d—d good lightning-rod." As a next step I found that only *green* twigs would work because, I said, a dry one is not a conductor. Then I went to my book again and read that electricity tends to make a complete circuit; hence, I said, the charge from the ground enters my body, passes thru it into the green stick from my arm and makes a magnet of its point, drawing it downward to the source.

So far so good. But how about the depth to dig? Experiments proved that as the electricity ascended toward the surface from the vein or generator it spread out in a funnel shape, so that the distance from the point where the stick began to be affected to where it stood vertical and motionless was exactly the same as from the second point down vertically to the vein. I never found this measurement at fault.

Now all was complete and I was satisfied; so were my friends, but I must go further. I went to all the men of this "gift" I could hear of, and without disclosing my purpose questioned them closely, with the result that their experience substantiated mine in every particular, even to the slight tiresome constriction of the wrists alluded to in your article, much resembling the sensations from holding the poles of a weak battery. Then I published my discovery far and wide, convincing friends and believers of the "water-witch" and many who but for the explanation would scoff at the whole subject. Among these latter were the professors in my Alma Mater, in later years, before whom I gave a satisfactory demonstration twenty-three years ago. I wrote the subject up for the *Scientific American*, but it was not accepted by the editors for the reason that they "did not accept the truth of the divining-rod superstition and therefore could accept no explanation of it."

Of course I could fill columns of your valuable paper with records of experiments and demonstrations, but perhaps this is as long a contribution as you care to use and I think it covers the ground I have in mind. I would like to hear from others on the subject, as I know there are thou-

sands adept in this practise and anyone is capable of it who is a sufficiently good "lightning-rod." F. H. GILE.

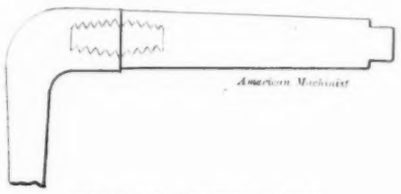
Greenfield, Mass.

Repairing a Broken Axle.

Editor American Machinist:

The accompanying sketch shows how an automobile axle was repaired so as to run home a distance of 12 miles without the aid of a hay motor.

The front axle broke square off next the shoulder for the cone. The two parts



REPAIRING A BROKEN AXLE.

were taken to a country blacksmith, where a half-inch hole was drilled and tapped in the center of each piece; a half-inch pin threaded on each end was then put in these holes and the two pieces screwed together and securely brazed. F. G. BUTLER.

T-Slot Dimensions.

Editor American Machinist:

The average draftsman thinks his drawing is completely dimensioned when he can copy it without scaling it. In most cases this does *not* give the dimensions in the best way for the workman. T-slots are one of the most common sources of trouble in this respect. Fig. 1 shows the almost universal method. To use this drawing the planer hand has first to add dimensions *C* and *D* to get the whole depth to run down his square-nose tool; then he has to subtract *A* from *B* and divide by 2 to get the distance to cut under. Both these operations involve fractions, and that

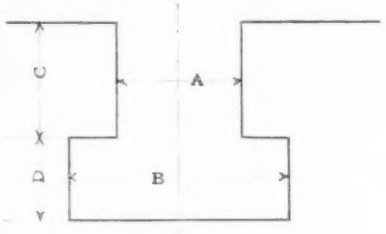


FIG. 1

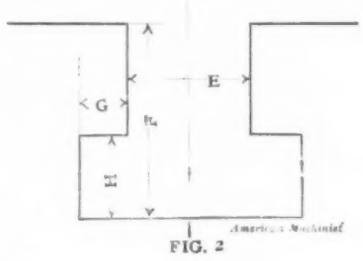


FIG. 2

T-SLOT DIMENSIONS.

is where he is lost. Suppose, as in a case recently seen, *B* is $1\frac{9}{16}$ inches and *A* $\frac{7}{8}$ inch; then $\frac{1\frac{9}{16} - \frac{7}{8}}{2} = \frac{11}{32}$. But can you imagine a shop man figuring this out with a two-foot rule and a lump of chalk, on the floor?

Fig. 2 shows how I, as a planer hand, would like the dimensions given. First, I want to cut down a slot of width *E* and depth *F*; then I want to pick out a pair of hooking-out tools of width *H* and long enough to cut under *G*. With these I will cut under a distance *G* on each side, and I am thru with it; and if it is wrong it is easy to tell who made the mistake.

PLANER HAND.

Improvements in the Universal Drafting Machine.

Editor American Machinist:

We had a large stock of drawing-boards which were too small for use with the universal drafting machine, owing to the fact that the instrument cannot be swung over the whole board if the chucking piece is fixed to the top left-hand corner. In

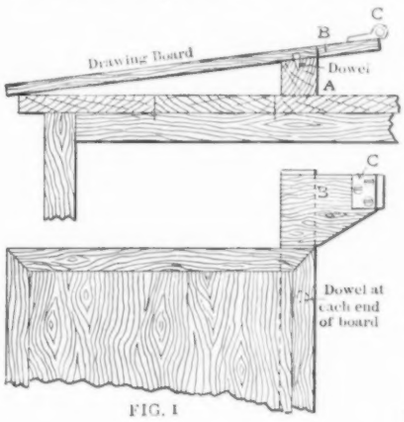


FIG. 1

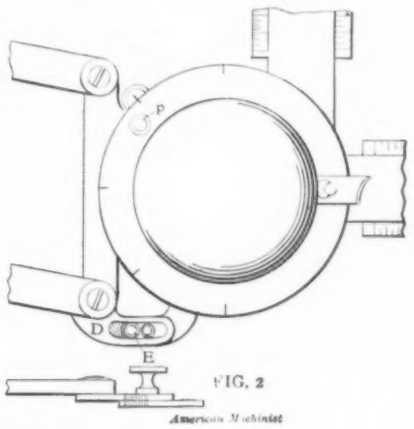


FIG. 2

UNIVERSAL DRAFTING MACHINE.

fact, the makers state that the board must be longer than usual, or an extension piece fitted. Fig. 1 shows how we got over the difficulty and at the same time provided means of readily interchanging boards when working on large scale drawings where two or more drawings are being worked up at once.

A bearer *A* is screwed to the bench and all the boards are doweled thereto by means of two ordinary patternmakers' brass dowels, in such a manner that the boards may be taken off easily. A wooden extension piece *B* carries the chucking piece *C*, to which the instrument is attached; and this is of such dimensions as will permit of the instrument entirely covering the boards.

Fig. 2 is another little improvement, the principle of which the makers would do well to incorporate in the tool. By filing out the hatched portion *D* and drilling and tapping another screw hole *E*, that part of the instrument carrying the index-plate and scales may be swiveled on the pivot *p* 10 degrees each way out of square or parallel, as the case may be, with the paper, enabling portions of a drawing which lie between 10 degrees out of square or out of parallel with the main parts of the drawing to be readily drawn, using the index plate for the common angles, just in the same way as if the instrument were set normally with the paper.

I would suggest in lieu of this that the instrument be redesigned to allow of a movement of the index-plate thru an angle of 45 degrees each way, which would enable any angularly laid out parts of a drawing to be drawn without the necessity of adding and subtracting angles. This would minimize the possibility of error and in addition combat another mind-distracter.

A writer at page 1022, Vol. 26, recommends that to avoid unnecessary strain upon the joints the pivot ring be carried by a wire attached to a rod spring from the chucking piece. After nearly eighteen months' use of the instrument, I can unhesitatingly assert that, however pretty the idea be in theory, this is quite unnecessary, for the various pivot pins are in as good order as when the instrument was new, and bid fair to last forever.

FRANCIS W. SHAW.

B——, England.

The Action of High-Speed Steel.

Editor American Machinist:

I have read the article at page 1080, by Mr. H. Eckardt, on the theory of high-speed steel with much interest and will say that I was a close observer of some recent tests made by the Carpenter Steel Company at Reading, Pa., of their Zenith high-speed steel, and the action of the steel while doing its work was identical with that described by Mr. Eckardt.

Mr. Miller, foreman of the machine shop, was able to judge with considerable accuracy as to the amount of work a tool would do by observing the ridge and depression at the cutting point after a cut was finished.

If the ridge was of good width there was no doubt of its finishing another cut, but if the depression was almost up to the

cutlery edge it was a sure sign that the tool would do but little more work, breaking down as soon as the depression had worked up to the cutlery edge.

These tests were made on mild steel and of course in a lathe, but I have observed the same conditions when gray iron was used, altho I don't think they were so noticable and they were the same in the several brands of steel used in the tests.

THEODORE.

Drilling and Tapping Small Holes in the Lathe.

Editor American Machinist:

Having a great deal of small drilling and tapping to do in the lathe, I thought it might interest your readers if I described the methods I employ in such work. Fig. 1 shows the tail spindle of lathe, with a taper plug *A* (of tool steel, hardened and ground) fitted to the center hole in the spindle. *A* has a fine thread cut on the front end, which engages with the nut *B*, which in turn presses the split collet *C* into *A*. *B* should be tool steel, hardened, and have a couple of spanner wrench holes in it, as shown. The collet *C* can be the regular collet furnished with the lathe, if you have it. You will notice that *C* is not keyed to *A*, as it is when using it in the head spindle. I have found it to be better to allow the collet to turn in its seat in *A* when tightening up on *B*, than to make the nut *B* turn on the front end of the collet, as the slots in the collet are inclined to hang to *B* under the

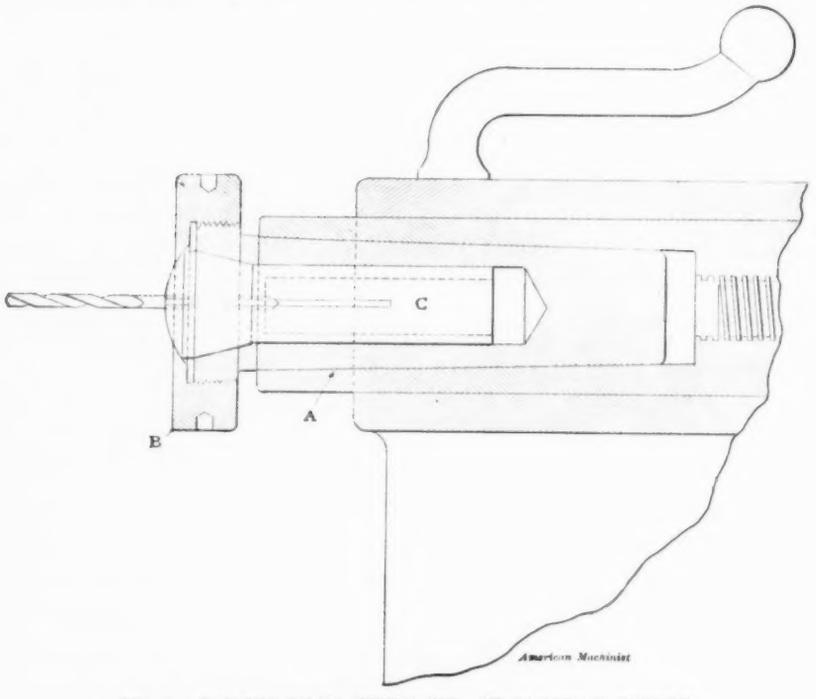


FIG. 1. HOLDING SMALL DRILLS, ETC., IN TAILSTOCK SPINDLE.

friction. This way of holding small drills in the lathe is, I think, much superior to the usual way of fitting a small drill chuck to the tail spindle, as the two-jawed drill chucks in common use are very apt to kink small drill shanks.

Fig. 2 shows an attachment for holding *very* small drills and taps in the lathe. *A* is a machine-steel piece fitted to the center hole in the tail spindle. *B* is a tool-steel bushing hardened and ground to fit the bore of *A;* and to receive the collet *C*, *B* has a fine thread on the front end to engage with the clamping nut *D*, also an-

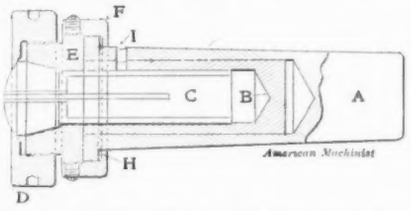


FIG. 2. FRICTION DRIVE FOR SMALL TAPS, ETC.

other fine thread at *E* to engage with the friction nut F, which is provided with a couple of set-screws with soft points (copper) to hold *F* securely from turning on *B*. *B* is a free running fit in *A*, and between *F* and *A* is a felt friction washer at point indicated by *H*. *I* is a hole into which a pin is put when screwing *D* on or off. This arrangement has saved me endless trouble in breaking small drills and taps. By careful observation in a short time I had the nut *F* graduated roughly to just about the point where certain sized taps and drills would revolve the collet and *B* in the friction joint without breaking. When drilling or tapping hard metal at a fair speed, if the flutes of drill or tap become clogged with chips, the only thing that can save them from breaking is some sort of a friction holder, such as shown.

Fig. 3 shows a simple split collet bushing, which is easily made of drill rod, for holding very small drills and taps in a larger split collet.

LATHE HAND.

Locomotive History.

Editor American Machinist:

It has been much pleasure and profit to me reading your description of the locomotives at the St. Louis Fair, and hope it is good history. If there is a greater advocate of Wm. Mason's ability as a locomotive builder than myself, it has not been my fortune to have met him. But at page 1056 Fig. 28 shows a Mason engine of 1853. That breed of Mason engines was not earlier than 1857, and if I were to guess on the one shown as above, I would place its birth at about 1860. All of Mason's early engines had wagon-top boilers, and I do not remember any that were of the straight-top form until 1857. The earlier engines had an angle-iron from the cab to the outside of the cylinder, same as Rogers was then using. That engine (No. 25, Baltimore & Ohio Railroad) was built for the United States Military Railroad about 1862 or 1863. It was named for one of our generals and was bought by the Baltimore & Ohio Railroad Company after the war was over—probably in '66 or '67. I feel confident this is correct I hope it will be possible for you to ascertain the date when the engine shown by Fig. 28 was made, and if I am correct, it should be so stated; for much of what is written about these things in the AMERICAN MACHINIST will be used as authority in the future.

Philadelphia. HENRY F. COLVIN.

Grinding High Speed Steels.

Editor American Machinist:

E. W. N., at page 1076, says "it's up to the emery-wheel man" to make high-speed steel an all-around success. They have the goods now. Years ago we condemned emery wheels for drawing temper on our tools; but just as soon as we dropped our grindstone pressure, we found it was the man and not the wheel. The present-day high-speed steels allow of pretty fast cutting with frequent dips in water, hand

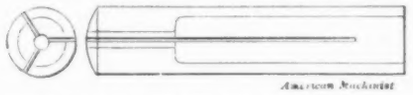


FIG. 3. SMALL COLLET FOR USE IN REGULAR SPRING COLLET.

grinding allowing a harder bond wheel than fixture grinding.

They make the right grade and bond today, but the wheels are not fool proof. One man will use a wheel and get all there is out of it; another condemns it, on the same class of work in the same shop.

A softer wheel has got to be used on high-speed steel and the pressure against the wheel lighter. Remember, a soft wheel means a sharp one—just the opposite from steel cutters; so it's up to the bond of the wheel.

A given bond, combined with a fine size of emery, forms an entirely different acting wheel from one with the same bond and larger grain. Think of the number of

combinations that can be made with the existing grade and bond lists of different wheel manufacturers. Do they need adding to?

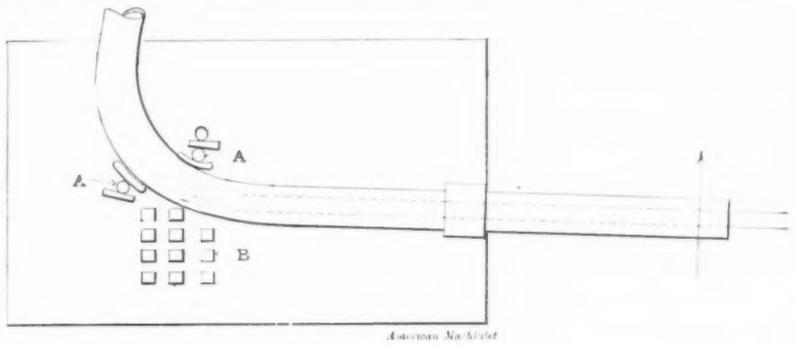
Working conditions, such as shape of work, ways of holding it, whether ground wet or dry, etc., govern to a large extent.

It's up to the operator, not the "wheel man." SCOTTY.

Bending Iron Pipe.

Editor American Machinist:

The following method of bending wrought-iron pipe up to 8 inches in diameter and to a circle of 5 feet radius is in regular use and may perhaps be of interest to those who would be puzzled if they had to do such a job. For an occasional job only, some modifications might suggest themselves, particularly in the way of a convenient substitute for the special table employed.



BENDING IRON PIPE.

A templet of about ⅛x1-inch stock is first made by the blacksmith. The pipe to be bent is laid on a table of gray iron having tapering holes *B* about 1¼ inches square over the entire surface to receive bars about a foot long. It is evident that by placing the pipe between two such bars as per sketch and putting a strain on the end of the pipe that the pipe will bend. It is well to reinforce the bars as shown. The method of heating the pipe is perhaps the best feature of the job. What is really a large blow pipe is made of two concentric pipes, natural gas being the fuel and a blower from a blacksmith's fire furnishing the air. By means of a simple arrangement of fittings, including some rubber hose, it was made so that the flame could be turned on any part of the pipe to be bent. The flame was of course *inside* the pipe to be heated. By this method a good, smooth job can be done. I might also mention the pieces marked *A* in the sketch are used to prevent the pipe being marred. B. A. T.

Improving the Radius Gage.

Editor American Machinist:

The radius gage shown at page 1075 might be improved on by the use of a nurled handle threaded to a shoulder at one end and then tapping the different sized balls to suit, the balls being hardened afterward, as any degree of accuracy lost would hardly be perceptible in this operation. Another very important use of a tool of this description, tho not necessarily made with such accuracy, is for the making of wax fillets in pattern work, the tool being kept heated over a gas flame warm enough to cause the beeswax to flow. A. B. C.

Making Lead Castings in Gray-Iron Molds.

Editor American Machinist:

At page 1073 Mr. Ernest Becker asks for some coating for the inner surfaces of his iron molds for lead castings. I think if he will paint them with heavy cylinder oil he will find it an improvement. VETERAN.

The American Society for Testing Materials.

We have received from Edgar Marburg, secretary-treasurer of the American Society for Testing Materials, a letter in which he says:

"An editorial of yours at page 974 contains certain references to the American Society for Testing Materials which are seriously in error. I quote as follows:

"'As is well known, our American society of testing engineers withdrew from the international society because the methods advocated here were not approved abroad and are in fact considered to be demonstrably bad.'

"The American Society for Testing Materials has not only not withdrawn from the International Association, but such a step has at no time been seriously contemplated. The American membership has risen in two years from 175 to 550, and is to-day far in advance of the membership in any other country. By the terms of our by-laws, membership in the International Association is a *sine qua non* to membership in the American Society.

"Our organization was chartered under its present name two years ago. Prior to that time it was known as the American Section of the International Association for Testing Materials. The change was made in pursuance of a suggestion from the president of the International Association on the ground that the statutes of the International Association make no direct provision for the creation of national sections. The present designation of the American branch of the parent body is similar in form, and its relation to that body is identical in character with that of similar organizations in Germany, France and other countries.

"That the American Society for Testing Materials is doing a great and useful work is attested both by the remarkable increase in our membership and by the high character and broad scope of our proceedings. It may indeed be claimed with confidence that there is not a technical society in this country whose efforts within recent years have been more widely or more favorably noticed by the American technical press. Your editorial, which is clearly founded on a misconception of facts, is the first adverse comment that has come to my notice. I am just in receipt of a letter from Prof. L. von Tetmajer, president of the International Association, congratulating our society on 'the brilliant result of its last annual meeting.'

"I shall not attempt here to reply to the sweeping and vague charge that the methods of testing advocated in this country are demonstrably bad; but shall content myself with the statement that it is one of the chief functions of our body to bring about betterments as speedily as possible in everything that concerns the testing of the materials of construction. Let me add for your information that at our recent annual meeting a resolution prevailed instructing our Executive Committee 'to consider the desirability of appointing a committee to study and report on the question of a Uniform Commercial Speed for Testing.'"

Needless to say, we are glad to have this official statement regarding the relation existing between the American and International societies of testing engineers, which we think is not generally understood. In a letter subsequently written, Mr. Marburg says, in effect, that one who is elected to membership in the American Society is, by virtue of such election and without further action upon the part of himself or anyone else, a full member of the International Association as well and entitled to all the privileges of membership. This we believe was not formerly the case, tho it is so now. Probably Mr. Marburg does not seriously disagree with us regarding the significance of Prof. Unwin's condemnation of certain methods of testing which we infer from Prof. Unwin's paper and the discussion upon it, are generally followed in England, and we believe are much too often, if not almost always, followed here. We shall hope the American Society will do much by means of such committees as that appointed to study and report upon the question of a "uniform commercial speed for testing" and otherwise to bring about reforms which we believe are needed.

A short answer stirreth up wrath, but a careful explanation satisfieth the customer. Smooth things over before they get set too hard.

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The index for the first six months of this year will be mailed to each subscriber with this issue. To those of our readers who purchase their copies at the newsstands we will mail the index upon application. Hereafter the paper will be bound in two volumes, No. 1 and 2.

Automobile Madness.

Probably few at the present day have any doubt as to the ultimate establishment of the horseless vehicle for general service upon our common roads. It is still, however, far from perfect or satisfactory for any line of duty, but is constantly being brought nearer to satisfying practical requirements, and is seeking to gain the confidence of its prospective users and ultimate beneficiaries. Its improvement and perfecting and its establishment in public confidence can be promoted by systematic, intelligent and honest experiment. Protracted trials under actual conditions of use are very necessary for sifting out as rapidly as possible the things which cannot endure and for proving the features which lead to betterment. Even competitive trials may be considered necessary to bring out and develop the possibilities and to suggest the ultimate in sight in the way of improvement. The proposal to have a competitive tour to the World's Fair of a large number of automobiles was of course in this view generally approved of, and the auspices under which it was to be conducted would naturally seem to have been of the best. The American Automobile Association should properly be assumed to be the devoted friend and the diligent and trusted promoter of the automobile in America. It would be supposed to be alert to the best interests of the automobile, to be ready to do anything in its power to promote its profitable and satisfactory employment and should be the last to do anything to bring it into disrepute or to discourage prospective patrons and users of horseless vehicles in general.

It must come as a surprise, therefore, to the simple minded and confiding public to be told, as we are told in the latest issue of *The Horseless Age*, that precisely the worst instead of the best conditions and practises prevailed throughout the trial referred to and that the officers of the above organization were the most flagrant violators of all the regulations which common sense and considerations of ultimate interest would have dictated. It would seem that almost from the first all restraint and all considerations of decency were disregarded and that it became a devil-take-the-hindmost scramble. It appears that the officers of the run instead of attempting any restraint were leaders in law-breaking and general recklessness. It appears that the president of the association, notwithstanding his letter to the participants before the run, in which he urged moderation and proposed to give the public an object lesson in respect for speed laws and other proper and necessary regulations, several times made the fastest run of the day and made different stages at average speeds higher than the legal limits for the open country in the particular States traversed. "Contrary to the common run of law breakers," says *The Horseless Age*, "those who broke the speed laws in this tour carried with them representatives of leading metropolitan papers, in order that the news of their misdeeds might be reported far and wide." It would seem as tho the automobile needs to be protected from some of its friends.

Water Witchery.

We are not either believers or disbelievers in "water witchery." We are free to say that we don't know anything about it nor anything of an adequate or satisfactory explanation of its attendant phenomena. We published the article on this subject at page 964 because we considered it interesting of itself and because the incidents described took place in a well-known engineering establishment in England; some of the leading men connected with this establishment being personally well known to us. We believe, whatever may be the explanation of the things that took place, that they actually did take place just as described—and photographed.

Elsewhere in this issue a correspondent, who himself possesses this mysterious "gift," presents his explanation of it, and, whether correct or not, it is reasonable and bears every internal evidence of entire sincerity and candor. It may be taken for what it is worth. We shall never, at any rate, decline to present a record of observed facts or a reasonable attempt at an explanation of those facts, simply because they do not happen to agree with a preconceived notion or opinion of our own. Such a course is, we think, extremely unscientific.

It may be interesting to note in this connection that in its issue of August 4 *Engineering News* refers in terms of commendation to the employment by a certain town of a geologist, who studied the ground and gave an opinion as to its water-bearing qualities, the correctness of which opinion is yet to be proven by experimental borings or by actual digging of wells. At the same time our contemporary says: "There have been cases, we believe, where towns or small cities have engaged the services of local 'water witches' to advise them where to dig for an underground water supply; but while private individuals may still occasionally employ some party of local reputation to search for water with a hazel wand, we do not hear, nowadays, of such methods being adopted where large wells for public water supply are concerned.

"And now," our esteemed contemporary goes on to say, "after writing down our opinion above that in this age of enlightenment the 'water witch' and the hazel divining rod had disappeared, we found in the AMERICAN MACHINIST of July 21

[page 964] a contribution entitled 'A Water Diviner and His Work,' which shows that faith in the hazel wand and those expert in its use survives in England if not in this country."

It then goes on to abstract our article, carefully using the expressions, "he is said to have," "it is alleged," etc., and then closes as follows: "We might comment on the above from several points of view, but will confine ourselves to the interesting contrast between the investigation of underground waters at Waterloo, Iowa, and at Manchester, England."

Now, as we have said above, we do not either affirm or deny the reality of such a gift as "water divining." But so far as we know, the practise of water divining does not conflict with any well-established law of physics. In fact, Mr. Gile's explanation of the phenomena, which we print in this number, is *possibly* correct, whether it really is the correct explanation or not. This being so then, it seems to us that talk about "this enlightened age," etc., and the assumption that this is certainly nothing more than a superstition which has disappeared in this country, notwithstanding that it may survive in England, is not at all convincing or satisfactory. We would be much interested in seeing at least one of the several comments our contemporary might make on the original article. Will it deny the truth of the statements made? Will it say that all who observed the work were hypnotized? or will it say that it was only a series of unrelated but accidentally coincident happenings. Our specialty is in another field, and we cannot devote much space to the matter; but it directly concerns many who read *Engineering News*. To them it may be of very great importance to *know* whether there is anything in this matter of so-called water-witching or not. Perhaps it might not be a bad idea for our contemporary to investigate it, not from books whose authors scout the idea of any such thing, as being "unscientific," but from nature. Mr. Gile lives in Massachusetts, which is not far off. We judge from his letter that he would be perfectly willing to give all possible assistance to an investigator. If one should go there with a truly scientific, *i.e.*, an open and unprejudiced mind, possibly something of interest and value might be learned. Who *knows?*

The old and widely known Quintard Iron Works, of New York, was recently incorporated under the laws of the State of New York as the Quintard Iron Works Company and the following officers have been elected: President, Nicholas F. Palmer; vice-president, Stevenson Taylor; treasurer and manager, George Quintard Palmer; secretary and assistant treasurer, James M. Wellman. The company will operate the works at the foot of East Eleventh and Twelfth streets, this city, and will manufacture and repair steamers, land and marine engines and boilers, gas works apparatus, sugar machinery of all descriptions, and machinery in general.

Some New Things

A TUBE EXPANDER AND A DRILL GAGE AND BLOCK.

The Frasse Company, 38 Cortlandt street, New York, has brought out a tube expander which is suitable for tubes measuring half an inch inside. The rollers are made of Stubs steel rod hardened and ground to size; they are held in a casing which prevents them dropping out. The same concern has brought out a drill gage and block made of brass for drills from No. 1 to 60, which consists of three rectangular plates spaced parallel one above the other. The two top plates have drill size holes broached in them into which the drills are placed, while the bottom plate is left plain, and prevents the drills falling thru.

Machinery Day at the World's Fair.

Saturday, September 10, is to be "Machinery Day" at the World's Fair. The day is to be made particularly interesting and the week which follows will be in many ways the most important and most interesting of all the weeks of the fair. We can only suggest here how machinery may appeal to the general visitor or sightseer with average mechanical interests.

That first Saturday will be of great interest to all who are interested in steam engines, steam turbines, gas engines, machine tools, wood-working and abrasive machinery, and the myriad other appliances shown in Machinery Hall. Not only will every power unit in the 50,000 horsepower end of the building be in operation all day, but arrangements have been made to have special demonstrations carried on in various portions of the building. Barrel-making machines will show how it is possible to make a flour or sugar barrel out of the rough wood for less than three cents each, grinding machines throwing out live fire amid fountains of water will show how they can cut steel as rapidly as a lathe tool, while in lathes and planers tools of the new self-hardening steel will demonstrate their ability to take off steel chips.

Leather belts successfully operating in water, submarine mines ready to blow up warships, wooden pulleys as high as a two-story house, dredge scoops that take up a couple of tons at a bite, conveyors for packing boxes and for coal, an automatic electric elevator, are some of the features to be seen in the building. Many of the exhibitors will hold special receptions on that day, and there will be music all day with music, refreshments and dancing in the evening.

On Sunday the American Institute of Electrical Engineers with hundreds of electrical engineers as guests from England and the Continent will arrive at St. Louis for the Electrical Congress which will continue thru that week.

On Wednesday Electricity Day will be celebrated. Every exhibitor in the Electricity Building is preparing some special stunt for that day, and jointly they will have water and land parades with illuminating effects never before shown on the fair grounds. St. Louis Day follows, September 15. This will probably be the most notable day of the fair for attendance. To the special attractions which will be provided for its celebration will be added those prepared for Electricity Day, for these will be again shown on St. Louis Day. Many bodies of engineers and other prominent persons from home and abroad are expected to visit the fair during that week. At the end of the week, after perhaps another Saturday night on the Pike, the visitor can go home feeling that he has done the fair and done it properly and he will have another Sunday ahead in which to recuperate.

Titles on the Backs of Books.

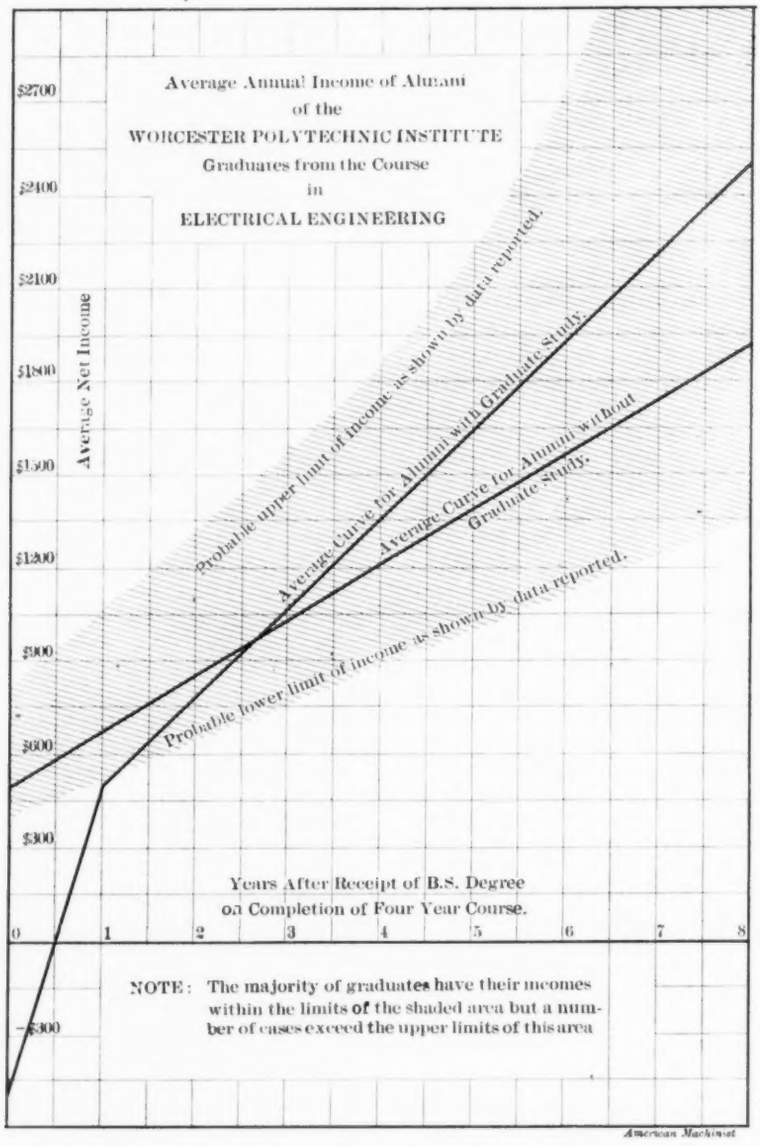
We have received from the Derry-Collard Company a letter, in which they say:

"Your criticism regarding the omission of the name from the back of our new book, 'Boiler Construction,' by Kleinhans, was noted, and we feel that an explanation is due. We thoroughly realize the convenience of having the name appear on the back of every book where possible, and intend to use it in every case. There were a number of very exasperating delays in the production of this book, one of which resulted in our reprinting four forms of the whole edition in order to have the illustrations come up to our standard. We were holding several hundred orders for the book and did not feel justified in delaying the first edition a day longer than was necessary. For this reason we overlooked the omission in the first lot received from the binders, but can assure you that the next will have the back stamp as it should.

In a printed reply to Mr. M. W. Ridley, who asked whether, in view of the fact that forged steel supplied to the Admiralty for ships' purposes under contracts with British firms was stipulated to be of British made billets, the Admiralty would take into consideration the desirability of similar practise in respect of brass castings for the same purposes, and stipulate that they be made from copper and tin of British manufacture, Mr. Pretyman says the matter has been considered by the Admiralty, but in view of the large demands which would be made upon the inspecting officers in securing the actual carrying out of such a stipulation, the ease with which it could be evaded by contractors, the impossibility of verifying the origin of all materials used by them for such work, and the enhanced cost involved, the Admiralty are not prepared to adopt the course suggested.—*The Engineer.*

The Successes of Technical Graduates.

In the presidential address of Mr. James M. Dodge, on "The Money Value of Technical Training," before the American Society of Mechanical Engineers, it will be remembered that he gave some carefully prepared averages of the earnings of men in different positions in life. He found that the average unskilled man at twenty-two years of age has reached his maximum earning capacity of $510 per year, which, capitalized at 5 per cent., gives him a potential value of about $10,000. The shop trained man reaches his maximum of $790 per year at twenty-four years of age, while the curve of income for the technical school graduate of ten years' standing is still rising at thirty-two years of age, when he receives an annual income of $2,150, which gives him a potential value of $43,000 when capitalized at 5 per cent.



From advance sheets of the *Journal of the Worcester Polytechnic Institute* we here reproduce a diagram prepared from data received from graduates of the electrical engineering department of the above institution which confirms the conclusions drawn by Mr. Dodge and further emphasizes the value of a thorough technical training.

This diagram is probably unique in that it shows most completely the financial prospects of technical graduates from year to year. As the Department of Electrical Engineering at the Worcester Polytechnic Institute has been established but eight years, there are data available for this period only, but during this time a large number of students have graduated, and data have been received from a sufficient number of them to represent conditions fairly. From these curves, it is seen that the average graduate who receives $500 per year for his first position after leaving the Institute rapidly increases in value, so that at the end of eight years he may expect to receive an income of about $1,900; or, if he has been a graduate student at the Institute for one year, his income is shown to average about $2,500, which, capitalized at 5 per cent., gives him the income on an investment of about $50,000. By investing five years of his time and the cost of his college training, he has after a few years and for the remainder of his life increased his income earning value by not less than $40,000.

Echoes From the Oil Country—Surface Indications in the Machine Shop.

"I am going to quit and go somewhere else, and see if I won't get a better show."

"What is the matter with you where you are? You have been there a good many years, and should be worth as much to them as you would be to anyone else."

"I've been there long enough. I guess I've been there too long. Kids that don't know half as much about the business as I do have been shoved in whenever there was a good job going, and I don't think that they ever think of giving me anything better. I'll just get out and try it somewhere else."

"When you saw that there was a job vacant that you thought that you would like and that you could fill, did you ever give the boss a hint that you would be a good man for it?"

"No, I never did. I am not one of those fellows that is always 'sucking' around the boss. I wouldn't do that if I never got a show. I'm not built that way, and I intend to go where I won't have to."

"That sounds very nice from your standpoint, but I would like to know if you ever got over the fence and tried to see it from the boss's standpoint. You have always had a good machine, and it has had a good line of work on it. The boss has certainly appreciated your ability that far. What did you ever say or do that would make him think that you would be a good man for boss of a gang? What is there about your actions that would make him recommend you as a good man to send out to a place where something has gone wrong, to smooth the matter up? Yes, I know that young Davis is only a kid that does not know half as much about the work as you do, but I also know that he uses good language, and can tell what he knows in a way that you cannot. When he goes to a man who is not a mechanic that is what he is judged by. I know old Bob Jenks, too. He is as fine a mechanic as you will find in this section of the country, and goes home without washing up, and he dresses like a second-rate tramp, and talks worse than one. He is all right in a toolroom by himself, but is entirely too 'grouchy' to handle a shop full of men."

"I guess you are right. I've noticed right along that the fellow that was stuck on himself, and had enough 'gift of gab' to let everyone know what a smart fellow he was, always got the best of it."

"If you will make i a little broader you will be not far from right. The fellow that has a good opinion of himself to start with, and that works and studies so that those who know him will have the same kind of an opinion of him, and who is

willing that others should know it, is more apt to get the chances that are going than the fellow who hides his talents in a hole and rather resents any trying to drag them out for inspection."

The foregoing was brought about by the fact that a man did not get a position that he thought he could fill and which he seemed to think he was entitled to by reason of length of service for the firm.

It is a subject that often comes up in every shop, and often it makes trouble for those in charge when they do not suspect that it is the cause. There is no doubt that different selections of men to put on important work would often be made if the management could be as well acquainted with all of the traits of the men as the men in a shop get to be with those of each other. This is of course impossible, and so those in charge have to form their opinions from the views they can get. How much can a man who desires to advance help them to get a correct view of him and of his capacity? If he hasn't any ability or capacity he should certainly keep very quiet and he will last longer.

One day there drifted into the shop a "natural mechanic." This man did certainly deserve that designation if ever any of the products of this section did. As far as I know he was without any other mechanical education than that which comes from working on a farm and around a sawmill. He brought with him a patent, and a large amount of cheerful hopefulness and faith in himself. After the years that have passed since our first meeting he still has a valuable stock of the latter on hand. It has been worth more to him than the patent, altho some of his experiences with the patent were extremely interesting. One of them which he related the last time I saw him shows how we all are judged by appearances.

This man who had been raised around wood, and wood-working machinery, had seen that certain work was done in a way that was very wasteful of material. The machinery by which it was done was simple and strong, and very well suited to be handled by unskilled persons. His invention was intended to stop the waste and to better the quality of the output, besides making it available in a way that up to this it had not been. To do this he had to substitute a very complicated machine for the simple ones then in use. Being without mechanical training his first machines were crude, and while they illustrated the principle to some extent, they would not stand up to the usage they were bound to get. Finally he got a machine that he believed would do the work, interested some parties who would be largely benefited if the machine was as he pictured it, and it was set up in their factory to be tested against the regular machines. Besides the machine being complicated in itself, its functions had been extended so that it did the work of several of the simple machines, and so it had the added air of mystification and of complication that comes to the unmechanical mind from mere size and numbers of moving parts. To those accustomed only to the machines usually used for the work, it was indeed a wonder.

When it came to getting out the work with it the inventor was the man, and he was also expert in keeping it in condition to do the work. As his success depended largely on demonstrating that it would pay to use his machines he spent his time in the factory, and ran the machine himself. A number of tests were made before various committees of men interested in this sort of work, and after each test the machine would be gone over carefully by the inventor to see that everything was in the best possible shape for the next trial. It was during these periods that he used to have his fun. Imagine him, clad in overalls, with a ten-cent cap pulled down over his eyes, tinkering around the machine, when an interested party would stroll up and remark, "This is quite a machine," thinking that he was talking to some laborer whose business it was to keep the machine clean.

"It may be," the inventor would reply, and then he would add, "What makes you think so?"

"Why, I understand that this is the first machine of the kind ever invented. It isn't just an improvement on some previous machine like most inventions are. (This was one of the claims that the inventor had made so often that everyone who spoke of the machine seemed to say it naturally like.) The fellow that got this up must have had a great head on him."

"Pshaw! I know the fellow that got it up. He hasn't any more head on him than I have." Which was very true.

"Working around it must have swelled you up considerable. If your ability was a great as your conceit you would be smart."

"I'll just bet you cents to buttons that I am as smart as the fellow that got up this machine, and I am willing to bet money that I can prove it to you."

This would be looked on as good-natured banter by the gentleman.

After something of the same sort had taken place a number of times, one of the men happened to get acquainted with the machinist who had had charge of the building of the machine and who had been brought along to help over any emergency that might arise, and from him learned that the man who ran the machine was really the inventor of it, and he passed the word around. A number got together and went over to the machine.

The inventor was at work up on the machine.

"Say, neighbor, would you come down here a minut?"

Of course he came down as requested.

After they had all solemnly looked him over, the spokesman asked, "Would you mind taking off your cap for a minute?"

After the cap was off he was again looked over, particular attention being given to the head, then the spokesman remarked: "You are the last man I would have picked out as being able to invent anything, and if any of the others here can see anything about you to indicate that you have brains they can see more than I can." Evidently, the others did not see anything in that line, for they were silent. "I always supposed until now that it took good brains to get up a new sort of a machine that could be patented." And he took another inquiring look at the head.

The inventor was rather abashed to find how conclusive the evidence seemed to be against him in their minds, but he managed to remark: "I never felt that I was overloaded with the brains that I have had to carry around with me, but I lived in the country long enough to find out some things, and one of them is that you can't always tell how far a frog can jump by his looks, and another one is that a singed cat may be better than it looks. The mice it catches speak more for the cat than the noise it makes on the fence at night."

"Yes, but you don't always have a chance to see the frog jump."

I am not prepared to say how he should have dressed and acted to have had them feel that he was a really great inventor, but he had evidently missed the style as far as that lot of people were concerned.

Perhaps in time the colleges, or the correspondence schools, will give this very important subject the attention it deserves, and then it will be easier for everyone to find his proper place.

The mistakes that are made because the surface indications are not rightly construed are sometimes mortifying and costly in more places than in the oil country, and in some lines of business that are not hunting for oil. W. OSBORNE.

The Decadence of Paternalism.

It must be admitted that whether for good or evil the day of benevolent institutions on the part of employers is passing away. The same movement is general. I find it alike in Germany, England and America, where some very fancy experiments in the way of Arcadian settlements have not prevented prolonged and bitter strikes. On the other hand, the day of the pound-of-flesh employer is also passing away. . . . Profit sharing is one alternative; another is to provide really good factory conditions, good wages, and every internal arrangement which conduces to efficient labor, while avoiding outside interference partaking of paternal relations. This principle marks some of the most modern and efficient concerns in all three countries. Both methods are sound; their combination would be impregnable.—Correspondence of London *Times* reprinted in *Consular Reports*.

Automatic Relief for Slotting Machines.

BY FRANK B. KLEINHANS.

It is a well-known fact that in reciprocating machine tools it is advisable to keep the tool from sliding over the work on the return stroke. This is particularly true in the case of slotting machines, because there is considerable spring in the machine when working under a heavy cut. This spring is usually in such a direction that when the cut is removed the tool stands somewhat nearer the work depending upon the spring. Thus the tool slides back over the work with considerable pressure.

On most machines the head of the cutter bar is arranged on a swivel *A* similar to Fig. 1. A spring *S* keeps the apron in place, but will allow it to swivel thru a small arc on the return stroke. The force of the spring is sufficient to grind away the cutting edge of the tool. A number of devices that have proven satisfactory are shown in the illustrations.

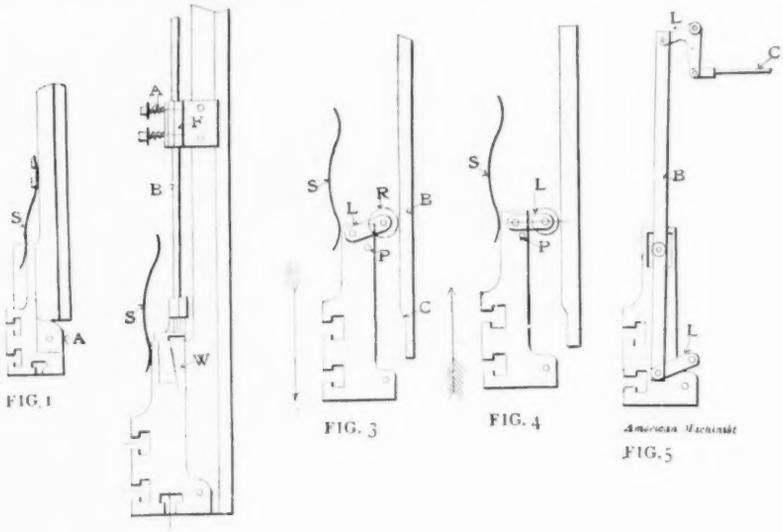


FIG. 1 FIG. 2 FIG. 3 FIG. 4 FIG. 5

VARIOUS RELIEFS FOR SLOTTING MACHINES.

Fig. 2 shows a device which is operated by a wedge *W* and a friction block *F*. The cutter bar is allowed to run over the stroke at the top and the bottom for a short distance which is sufficient to engage and disengage the wedge which raises and lowers the tool. The bar *B* is made of cold-rolled steel and is a sliding fit in the friction block *F*. Adjusting springs *A* between the cap and the heads of the tap bolts enable one to obtain any desired friction.

The machine is set in motion and the springs *A* are adjusted so as to push the wedge into place, as the cutter bar begins its return stroke. The apron is thus raised and the tool relieved; as the cutter bar recedes the wedge is pushed up against a shoulder at which place it remains until the cutter bar has returned to the top of the stroke. The cutter bar now advances on the downward stroke, the friction rod holds the rod *B* and thus the wedge *W* is drawn out of its position, the spring *S* returns the apron against the cutter bar and this furnishes the solid support for the cutting stroke of the tool.

Another device is shown at Figs. 3 and 4. *B* is an adjustable bar which is attached to one or the other of the cutter-bar gibs. *L* is a link which supports the roller *R*; *P* is a stop pin. In the position shown, the cutter bar is advancing against the cut. The motion keeps the link in the position shown. It will be noticed that a short cam *C* is provided on the lower end of the bar *B*. The bar must be adjusted so that the roller passes the cam and falls down into a horizontal position just as the tool is at the bottom of the stroke.

When the cutter bar returns, the roller comes in contact with the cam and the apron is tilted as shown in Fig. 4. The link is forced down against the stop pin and remains in this position until the cutter bar returns to the top of its stroke. The bar now advances, the downward motion throws the link *L* out and the spring *S* snaps the apron back in its original position. There is one marked difference between this device and the one just described—the first throws in and out smoothly and easily, while the latter throws out quickly and always snaps back in an instant; it nevertheless is a good and inexpensive device.

Fig. 5 represents a device which does not need to be adjusted for different positions of the cutter bar. The parallel motion links *L* and *L* keep the bar *B* always in a vertical position. The connection rod *C* is attached in the same way to the same cam on the main shaft from which the feed motions are obtained, and thus it receives a reciprocating motion which conforms to the stroke of the cutter bar. In the position shown the bar is on the downward stroke. When it arrives at the end of the stroke, the connecting rod throws the bell-crank arm, swivels the apron thru a small arc and thus automatically relieves the tool.

Technical Publications.

We have received the fourth section of a German work on marine boilers, by Walter Leps, published by C. J. E. Volckman at Rostock. The third section was noticed at page 538.

"Friction and Lubrication." By William M. Davis. Second Edition. 257 8¼x5¾-inch pages. 69 illustrations. Lubrication Publishing Company, Pittsburg. Price, $2.00.

The first edition of this book was favorably noticed by us last October. The present edition is a better piece of bookmaking and thirty-three pages of new matter have been added by the author. The subject is treated from the point of view of the man who buys and uses the oil, and the book is eminently practical.

Personal.

It is announced that Dr. Hans Goldschmidt is to visit the United States in the near future. He comes as the delegate of the Bunsen Society of the International Electrical Congress at St. Louis in September. It has been provisionally arranged for him to give an address and exhibition of Alumino-Thermics on September 13 in the hall of the Westinghouse Company.

Obituary.

Noel Earl Sisson, for many years a manufacturer of gas meters, died at Albany, N. Y., August 11, eighty-three years old.

Peter Lindsay, a retired iron founder of Philadelphia, died August 19, eighty-five years old. He was a working molder and a foundry foreman for many years. In 1880 he established the Reliance Foundry in Philadelphia, and in 1899 he retired and was succeeded by his son.

George F. Blaisse, superintendent of the Thackara Manufacturing Company (gas fixtures), Philadelphia, died August 16, seventy-three years old. He entered the employ of the company before the Civil War, in which he served and returned to remain with the company until his death.

Business Items.

The Standard Brazing Company has licensed Herbert O. Rockwell, of Amsterdam, N. Y., to do brazing for the general trade.

The Sprague Electric Company has sold to the Hammerschlag Manufacturing Company, Newark, N. J., an additional order, consisting of one 150-kilowatt generator and twelve motors, ranging from 1 to 50 horse-power. These are for use in the Hammerschlag wax paper plant, which is one of the largest of its kind in this country.

The Rand Drill Company is shipping an Imperial compound air compressor to be used on the extension of the Chicago drainage canal. A compressor of the same type is already in operation on this work and is furnishing compressed air for ten Little Giant drills. The two compressors have a combined capacity of furnishing 3,400 cubic feet of free air per minute.

William H. Latshaw, formerly vice-president of the National Tube Company, has organized the Latshaw Pressed Steel & Pulley

Company, of Allegheny, Pa. The company has purchased the plant of the Bradley Manufacturing Company and is installing new machinery. The product is to be pressed steel pulleys, and also a novelty in the pressed steel line in the form of bells and gongs. It is claimed that the patents that the company has secured will enable it to turn out pressed steel bells and gongs which for tonal qalities will exceed the finest alloys of metal that are usually cast into bells.

Manufacturers.

A big plant will be built for the Schenectady (N. Y.) *Daily Union*.

Girard & Godin's coffin factory in Three Rivers, Que., has been burned.

The Gardner Governor Company, Quincy, Ill., is adding a new power-house.

The Santa Fe officials expect to build a new boiler shop at Newton, Kan.

I. E. Palmer, nettings, etc., Middletown, Conn., proposes to enlarge his plant.

A new factory is to be built by the Gem Knitting Mills Company, Reading, Pa.

The Evansville (Ind.) Metal Bed Company is to build a plant, two stories, 160x360 feet.

The Record Foundry Company, Livermore Falls, Me., is erecting a 60x184-foot building.

The Franklin (La.) Progressive Union is promoting a cannery; capital stock to be $50,000.

The plant of the Consumers' Electric Light Company, Little Falls, N. Y., has been burned.

The establishment of the Park Furniture Company, Rushville, Ind., has been damaged by fire.

The plant of the Barber Asphalt Paving Company, in Philadelphia, has been damaged by fire.

Reid, Murdoch & Co., Chicago, are to erect a big plant at Hammond, Ind., for canning purposes, etc.

The Charlotte (N. C.) Pipe & Foundry Company has bought some neighboring factory property.

Le Roy Roundy, West Burke, Vt., is talking of putting in a dynamo and furnishing electric lights for the village.

Work on the Mexican Car & Foundry Company's buildings at Hutchinson, D. F., is being pushed vigorously.

A certificate of organization has been filed by the Bridgeport Foundry & Machine Company, of Bridgeport, Conn.

The Henderson Roller Bearing Company, Toronto, Ont., intends to establish a branch factory in Winnipeg, Man.

The Klotz Machine Company, Sandusky, O., has awarded the contract for an addition, 60x110 feet, three stories.

The factory of the Fauber Manufacturing Company, automobiles, etc., Elgin, Ill., has been badly damaged by fire.

The Buck Mountain Heat & Power Company, recently chartered, proposes to erect a plant at Buck Mountain, Pa.

Kearney & Trecker, milling machine manufacturers, West Allis, Wis., are about starting to build a small addition.

The Cincinnati (O.) Industrial Bureau has secured a starch company, of which the president is Charles B. Smith.

Ground has been broken at Vermilion, O., for a plant for the Duplex stamping company, backed by Cleveland men.

Dodd & Struthers, manufacturers of X-ray machinery, copper cable rods, etc., Des Moines, Ia., are enlarging their plant.

The Menominee (Mich.) & Marinette Light & Traction Company proposes to install a new gas plant at Marinette, Wis., at once.

A four-story, 115x125-foot mill will be constructed to be occupied by Friedlander, Brady & Co., manufacturers of knit goods, Chicago.

The Humboldt machine shops are being built at Humboldt, Tenn. The project is being pushed by Messrs. Allison, Hudson and Folis.

The Des Moines (Ia.) Bridge & Iron Works are preparing for extensive enlargements and will probably commence work on them in another year.

A branch of the Arms Palace Horse Car Factory may be located at Marshall, Mich. H. H. Arms, of Toledo, O., is said to be considering the idea.

Lauren Gardner, of Rochester, N. Y., has bought mill property at Mumford, N. Y., and will use it in the manufacture of paper. It has water power.

The Badger Brass Manufacturing Company, manufacturer of automobile lamps, Kenosha, Wis., has purchased a site and will erect a larger plant.

E. Litchfield, of New York, represented by J. B. Weaver, Jr., of Des Moines, Ia., may build a large gypsum mill at Fort Dodge, Ia., before a great while.

The directors of the American Car & Foundry Company have decided to build an addition to the plant at Berwick, Pa., 200x188 feet, to cost $100,000.

Peoria, Ill., is trying to secure an enterprise for making tool steel or something of that sort. The Peoria Improvement Association is evidently posted.

The Manchester (Ia.) Fence Company, organized recently for the manufacture of wire for corn cribs and woven wire fencing, will erect a 40x60-foot building.

Estimates are being taken for the erection of a factory building and power-house for the Victor Talking Machine Company, at Front and Cooper streets, Camden, N. J.

A $20,000 addition will be made to the State reformatory at Green Bay, Wis. The improvements will include a new engine and boiler rooms, machine shop and laundry.

The Atlantic, Gulf & Pacific Dredging Company has decided to build a shipyard and dredging plant in Alameda, Cal. It is now constructing marine ways in West Oakland.

The Ansonia Copper & Sheet Iron Works, Cincinnati, O., has applied for a permit to erect a shop on Evans street, between the C., H. & D. and Eighth street, to cost $8,000.

A concern from southern Pennsylvania, which manufactures special machinery, is in communication with the Board of Trade, Lestershire, N. Y., with a view to locating there.

The Linden Manufacturing Company, manufacturer of watch materials, has arranged to move its plant from Aurora, Ill., to Fulton, Ky., where it will enlarge its business.

The Richmond Manufacturing Company's Namquit Mill, Bristol, R. I., has been sold to Chas. B. Rockwell, a man identified with that place, who will equip it for weaving worsted cloth.

Henry Kniphals, of Davenport, Ia., recently perfected a new potato digger, and a plant may possibly be started to manufacture it there, but nothing definite was decided at the last account.

The Committee on Water-works and Electric Lights of the City Council, Springfield, Tenn., has selected a site for the power-house. A pump-house, filter, etc., will also be established.

A movement is on foot among citizens of Carlisle, Pa., to enlarge the Carlisle Body & Gear Works, by putting more capital into it and doubling the output and the number of mechanics employed.

W. H. Strouse, an Iowa Central engineer, has perfected an automatic locomotive stoker. A company with sufficient capital to start in the business of manufacture at Oskaloosa, Ia., has been formed.

Articles of association have been filed by the National Wire Cloth Company, of Niles, Mich. It will manufacture wire, wire cloth, screens and all kinds of wire goods. It is capitalized at $50,000.

Hill & Waltersdorf are preparing plans for a manufacturing building to be erected at Green and Congress streets, Chicago, for Richard Reynolds. It is to be four stories and basement, 116x125 feet.

The United States Register Company, Battle Creek, Mich., has bought another factory, so that the labor of nickeling and stamping its registers can be done in Battle Creek, instead of Cincinnati.

A company for the manufacture of four patented articles and promoted by John Loth, inspector of weights and measures, is being formed at Muncie, Ind. One of the articles will be a woodworkers' try-square.

Dr. J. H. Koons, Waynesboro, Pa., proposes to erect a factory, 24x36 feet, two stories high, and equip it with machinery for the manufacture of the Eureka fly screen, etc. He has also a lifting jack specialty.

The Wellman-Seaver-Morgan Company, Cleveland, O., has just been awarded the contract for building complete the great rail mill to be installed by the Dominion Iron & Steel Company, Ltd., at Sydney, N. S.

It is stated at Johnsonburg, Pa., that the New York & Pennsylvania Company, manufacturer of chemical fiber and paper, is considering the advisability of erecting an electric bleach plant at the Clarion mill.

It is stated at Joplin, Mo., that the Underwriters' Mining Company is starting shafts with the intention of building a large mill. The plant is located in the Webb City district; company's exact address not stated.

It is stated that John A. Roebling's Sons Company has purchased 200 acres of land in Kinkora, N. J., on which it will erect a building for a rolling mill, which will be moved from Trenton, N. J., and also a steel mill.

Secretary Barclay of the Board of Trade, Cairo, Ill., has been in correspondence with a company operating a large factory for breast yokes, single and double trees and other wagon parts, which talks of locating there.

A large silk mill is to be located at Economy, Pa. J. P. Shorrock, of Paterson, N. J., is active in the matter. The new concern is called the Economy Silk Manufacturing Company. Two mills in Paterson will be moved there.

Plans for the new Crow Hosiery Mill at Monroe, N. C., call for a structure, 40x180 feet. The company has elected R. A. Morrow president; J. M. Belk, vice-president; J. J. Crow, secretary-treasurer, and H. E. Wilson, superintendent.

The plant of the Stilwell-Bierce & Smith-Vaile Company, at Dayton, O., has been sold to Col. J. D. Platt for $775,000, which is materially less than the appraised value. It is not certain, tho quite likely, that the court will confirm the sale.

The Buckley & Jennings Company, of Oneonta, N. Y., has been incorporated with $100,000 capital stock to manufacture underwear. The directors are: Henry H. Buckley, of Oneonta; W. B. Jennings, New York city, and W. D. Buckley, Sloan, Ia.

It is rumored that a large plant for the manufacture of shoe machinery is to be built in Fairhaven, Mass. The company pushing the project is said to have its headquarters

in Boston, and plans to compete with the United Shoe Machinery Company.

The Chamber of Commerce, Colorado City, Colo., has received a letter from William Hubarth, president of the Hydraulic Water Motor & Power Company, of Denver, written with a view of organizing a company and inquiring about location for a factory.

Commissioner Oakley, of the Department of Water Supply, Gas & Electricity, has invited bids on triplex pumps and gas engines with all appliances for a high-pressure salt water fire service pumping plant for New York city, to be located at Coney Island.

It is probable that steps toward the organization of a company to erect a plant in Columbus, O., for the manufacture of the digging machine invented by J. H. W. Libbe will soon be taken. Judge Gilbert H. Stewart has been interesting local capitalists in the machine.

It is reported that a plant of the Best Manufacturing Company, of Philadelphia and Pittsburg, is to be moved to West Pittsburg, a new industrial town six miles south of New Castle, Pa., and be ready for operation January 1. The plant will be enlarged when moved and will employ 650 people, nearly all skilled workmen. The product is brass valves and engine fittings.

It is stated at Taunton, Mass., that the Watuppa Mill, which will occupy the old Canoe River Mill building, will be in operation the latter part of the year or the first of next year. A large addition will be built to the mill and from 1,000 to 1,500 hands will be employed. Knitting will be done exclusively.

The old plant of the Manitowoc (Wis.) Machine Company is being taken over by the Manitowoc Motor & Machine Company, a new concern to engage in practically the same business. The men in the new concern include J. B. Drahonovsky and John Tulach, of Chicago. The output will consist of gas and gasoline engines, etc. A plant has been brought from Chicago and added to the local one.

The Tucker Sheet Feed Company is the style of a concern just incorporating at Memphis, Tenn., composed of A. W. Whitaker, D. S. Rice, J. E. Tucker, W. S. Brian and J. H. Malone. The company will manufacture an automatic attachment for the Gordon job press. J. E. Tucker, connected with the firm of Wills & Crumpton, is the inventor of the feeding attachment. The company is capitalized at $20,000.

There is a rumor that the Albany Forge Company, of Albany, N. Y., whose principal office is in Colonie, will be in the market for machine shop and forge equipment for a plant. The company is said to have bought three acres of ground a short distance from the city limits of Albany, and to be arranging to erect a forge plant and furnace building and also a machine shop thereon. The company is capitalized at $80,000.

The Hendricks Manufacturing Company, Waynesboro, Pa., expects to take up the manufacture of Wm. H. Wolfe's patented tire-setter. It is understood that Mr. Wolfe will enter the employ of the Hendricks Company, giving his particular attention to the construction of his invention. He recently invented also a dish appliance by which wheels can be easily dished, and it will be manufactured to sell with the tire-setter.

J. P. Spiker and J. L. Black have purchased a three-fourths interest in the McDonald Machine Company's plant, Bowling Green, O. William Keller owns the remaining one-fourth and will act as manager of the new company, which will be known as the Superior Manufacturing Company. The new concern will do repair work and manufacture the Titus weeder attachment, a patent stuffing box and other lines of machinery.

The Akron (O.) dental rubber company has closed a contract with a firm of printers' roller manufacturers in the East to manufacture an improved roller, claimed to embody the first improvement in printing press rollers made within the past eighty years. The old ones are made of a composition of glue, molasses, etc., and are expensive. The new ones will be made mostly of sponge rubber, with a veneering of the regular composition, 1-16 inch thick. It is believed that this will prevent surface air holes.

Allentown, Pa., is to secure the American Corrugated Furnace Company, with a capital of $350,000, which will manufacture patented corrugated furnaces for land and marine boilers, and also pressed steel work of all kinds, such as automobile frames, car trucks, etc. One notable feature will be its welding department. The corrugated furnaces are those now manufactured by John Brown & Co., Ltd., of Sheffield, England. George O. Albright, president of the Allentown Foundry & Machine Works, is a director of the new company. Others are W. Carlile Wallace, Sheffield, England; Albert F. Matlack, William M. Watson, Mason G. Worth, president of the American Pressed Steel Company, of Philadelphia, and E. G. C. Bleakly, of Camden, N. J.

New Catalogs.

Ransom Manufacturing Company, Oshkosh, Wis. Disk grinders; descriptive pamphlet. Illustrated. 6x9, pp. 7, paper.

The E. F. Reece Company, Greenfield, Mass. Illustrated catalog and price list of screw plates, taps, dies, etc. 4x6, pp. 86, paper.

Jeffrey Manufacturing Company, Columbus, Ohio. Illustrated price list No. 62B of Jeffrey water elevators. 4¼x8, pp. 12, paper.

The Bristol Company, Waterbury, Conn. Recording pressure and vacuum gages, catalog No. 13; illustrated. 9½x12, pp. 20, paper.

Blaisdell Machinery Company, Bradford, Pa. Self-oiling air compressors described and shown in bulletin No. 12. 6x9, pp. 27, paper.

Jeffrey Manufacturing Company, Columbus, Ohio. "Jeffrey Grab Buckets," illustrated by half-tones and drawings. 4½x7¾, pp. 12, paper.

E. C. Bliss Manufacturing Company, Providence, R. I. Illustrated catalog of ornamental chain made by this company. 7½x10, pp. 25, paper.

Reeves Pulley Company, Columbus, Ind. Booklet descriptive of the "Reeves" iron center wood rim pulley. Illustrated. 3½x6, pp. 16, paper.

General Construction Company, Seattle, Wash. Catalog of Bewsher sand pumps and gold dredging machinery. Illustrated. 8x11, pp. 15, paper.

Foos Gas Engine Company, Springfield, Ohio. Catalog No. 14 of Foos gas and gasoline engines, stationary and portable. 8x10, pp. 39, paper.

Henry R. Worthington, 114 Liberty street, New York. Bulletin No. 100, descriptive of the Worthington steam accumulator. Illustrated. 6x9, paper.

United States Metallic Packing Company, Philadelphia, Pa. Metallic packings for stationary and marine engines. Illustrated. 3½x6, pp. 15, paper.

J. T. Slocomb Company, Providence, R. I. Micrometers and other machinists' tools. Catalog No. 2, with illustrations and prices. 6x8½, pp. 32, paper.

Thomas H. Dallett Company, Philadelphia, Pa. Portable drilling machinery, belt and electrically driven, described and illustrated in detail. 6x9, pp. 44, paper.

George F. Marchant, 39-41 W. Washington street, Chicago, Ill. Illustrated catalog and price list of "New Process" punches and dies and punch couplings. 3½x6, pp. 8, paper.

Nernst Lamp Company, Pittsburg, Pa. Revised edition of catalog No. 3 of 44- and 55-watt Nernst lamps for alternating current circuits; illustrated. 3½x6, pp. 14, paper.

R. D. Wood & Co., Philadelphia, Pa., "Gas for Power and Fuel," St. Louis Exposition number, dealing with producer gas plants installed by this company. 8½x11, pp. 12, paper.

The Jeffrey Manufacturing Company, Columbus, Ohio. Bulletin No. 9, "Instructions for the Care and Operation of Jeffrey Direct-Current Generators." Illustrated. 8x10, pp. 8, paper.

The Stiles-Morse Company, Chicago, Ill. "Bliss" machinery, folder showing a number of Bliss presses and other tools, for which this company is selling agent for Chicago and the West.

E. C. Atkins & Co., Indianapolis, Ind. 1904 catalog of saws, including circular, band, hack, cross-cut, rip wood saws, etc.; saw tools and mill specialties. Illustrated. 6x9, pp. 207, paper.

Diamond Drill & Machine Co., Birdsboro, Pa. Wagner cold saw cutting-off machines in universal, bar, beam and steel casting type, and automatic saw sharpener. Illustrated. 7x10, pp. 19, paper.

Brown & Sharpe Manufacturing Company, Providence, R. I. Booklet illustrating milling cutters of various shapes and sizes. A Brown & Sharpe cutter list will be sent to anyone upon request.

Joseph Dixon Crucible Company, Jersey City, N. J. "Oil Versus Grease" is the title of a recently issued booklet which treats of the uses and merits of Dixon's graphite greases. 5x7½, pp. 26, paper.

Jeffrey Manufacturing Company, Columbus, Ohio. Jeffrey "Century" rubber belt conveyors, their construction and application for varied services shown by many illustrations from photographs. 6x9, pp. 48, paper.

De Laval Steam Turbine Company, 74 Cortlandt street, New York. Bulletin No. 9, containing results of tests of De Laval centrifugal pumps by J. E. Denton and William Kent. Illustrated. 6x9, pp. 24, paper.

B. F. Barnes Company, Rockford, Ill. "Twentieth Century Machine Tools" is the title of a catalog illustrating the line of drills and lathes and the water tool grinder made by this company. 6x9, pp. 66, paper.

The Wellman-Seaver-Morgan Company, Cleveland, Ohio. Catalog descriptive of the Cockerill gas engine, containing full-page illustration of a heavy-duty Cockerill blast furnace gas blowing engine. 9x12, pp. 12, paper.

Becker-Brainard Milling Machine Company, Hyde Park, Mass. This company has issued a neatly arranged booklet illustrating its machines on exhibition in Block 13, Machinery Hall, Louisiana Purchase Exposition, St. Louis, Mo.

Reliance Pneumatic Tool Co., St. Louis, Mo. Pneumatic and hydro-pneumatic machine tools, portable and stationary, showing pneumatic staybolt cutters and breakers, bridge and girder riveters, etc. Illustrated. 6x9, pp. 16, paper.

Ridgway Dynamo & Engine Company, Ridgway, Pa. Bulletin No. 11, "The Thompson-Ryan Dynamo"; bulletin No. 12, "The McEwan Automatic Engine," and bulletin No. 13, "The Thompson-Ryan Variable Speed Motor," described and illustrated. 8x10½, paper.

Newton Machine Tool Works, Philadelphia, Pa. Catalog No. 39 of cold saw cutting-off machines. A large line of these machines, belt and motor driven, for standard and special service, are illustrated and briefly described. 6x9, pp. 27, paper.

American Locomotive Company, New York. A recent publication of this company illustrates and describes in detail the American Locomotive Company's engines on exhibition at the Louisiana Purchase Exposition, St. Louis. Illustrated from photographs and drawings. 6x9, pp. 43, paper.

The Reed-Morrill Electric Company, Philadelphia, Pa. Catalog describing the construction and adaptation of the speed-jack, a variable speed apparatus for use with machine tools and general machinery recently put on the market by this company. Illustrated by drawings. 6x9, pp. 15, paper.

The Cutler-Hammer Manufacturing Company, Milwaukee, Wis. We have received a number of insertion leaflets or bulletins showing many products of this company. These include self-starters, drum controllers, nonreversible and full-reverse machine tool controllers, outfits for small motor-driven pumps, etc.

National Machinery Company, Tiffin, Ohio. 1904 catalog of National bolt and nut machinery, forging and bending machines, wire, nail, spike and special machinery. Illustrated. A number of appended pages contain useful tables of dimensions of threads and bolts, weights of bolts, etc. 8x10, pp. 169, paper.

Betts Machine Company, Wilmington, Del. Catalog showing the full line of boring and turning mills made by this company. These include standard and extension boring and turning mills, tire turning and boring mills, car wheel borers, and the various attachments supplied for special work. Ample descriptions and full-page illustrations. 6¾x 9¾, pp. 60, paper.

The Wellman-Seaver-Morgan Company, Cleveland, Ohio. "What We Do" is the title of a brochure telling of the varied lines of consultation, installation and manufacturing work undertaken and handled by this company. There are many pages of miniature illustrations of plants installed and bridges and other structures erected. 4x9, pp. 35, paper.

Gould & Eberhardt, Newark, N. J. Shapers and shaper attachments. Among the shapers shown are the regular and extension-base styles of Gould & Eberhardt "Double Triple Quick" stroke shapers in graded sizes from 16 to 34 inches, sinker head shaper and motor-driven shapers. The descriptions are ample and the illustrations are fine halftones. 6x9, pp. 36, paper.

Sprague Electric Company, New York. "Industrial Applications of Sprague Electric Motors," bulletin No. 218. Applications of Sprague motors to many representative machines, tools, printing presses, blowers, hoists and other machinery are shown by fine halftone illustrations. The bulletin will be of value to those interested in motor drive for machine tools. 8x10½, pp. 31, paper.

Cleveland (Ohio) Twist Drill Company. 1904 catalog containing illustrations and price lists of the full lines of twist drills, reamers, taps, mills, cutters and other tools made by this company. This is the largest catalog ever issued by the above firm. It is well printed and conveniently arranged, with half-tone illustrations throughout. Copies will be sent to those interested upon request. 6x9, pp. 117, paper.

E. W. Bliss Company, Brooklyn, N. Y. We have received from this company a catalog, printed in Spanish, showing a representative line of Bliss presses and other machinery for die and metal workers. Half-tone illustrations. The same company is also sending out a neat vest pocket book containing many pages of tables and data useful to engineers and machinists and showing some miniature illustrations of various Bliss presses.

The Gleason Works, Rochester, N. Y. We have received a very handsome piece of trade literature descriptive and illustrative of Gleason planers for bevel and spur gears. It is arranged in album form, wherein are mounted on heavy art paper fine half-tone reproductions of the various types and sizes of these machines. Detailed descriptions of the machines shown precede the section devoted to illustration, and appended are five pages of mandrel drawings. 9x12, pp. 21, paper.

Miscellaneous Wants.

Advertisements will be inserted under this head at 25 cents a line each insertion. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

Caliper cat. free. E. G. Smith, Columbia, Pa.

Punches & dies. Wal.M.Wks., Waltham, Mass.

Will buy or pay royalty for good patented machine or tool. Box 282, AMER. MACH.

Light mach'y to order; model work; rubber molds. J. W. Weir, Bridgeport, Conn.

Working drawings, tracings. Geo. M. Mayer, M. E., 1131 Monadnock, Chicago, Ill.

Light and fine mach'y to order; models and elec. work specialty. E. O. Chase, Newark, N. J.

A practical book, "Dies and Diemaking," post paid $1. J. L. Lucas, Bridgeport, Conn.

Automatic machinery designed and constructed by the Wellman Sole Cutting Machine Co., Medford, Mass.

Auto. machinery of all kinds designed and built; hardened and ground work, flat or circular. Wiebking, Hardinge & Co., Chicago.

Wanted—Drawings and patterns for simple and practical four-cycle gasoline engines up to 10 H.-P. Box 290, AMER. MACHINIST.

A director of methods for increasing machine shop output solicits engagements; vast experience; excellent record. Box 196, A. M.

Will purchase, or manufacture on royalty, patented machine of merit. Address, with full particulars, Box 176, AMER. MACHINIST.

Addressing machines without type; high speed; run by motor or foot power; write for the picture book. B. F. Joline & Co., 123 Liberty st., New York.

Wanted—By fully equipped and modern machine shop, special machinery or machine parts to build by contract or day work. Address Ingle Machine Co., Rochester, N. Y.

Mechanical engineer would interest manufacturer or party with small capital in new planer (or other tool) reversing mechanism; patent ready to issue. "Hack," care AMERICAN MACHINIST.

Mechanical engineer and shop man would like to interest responsible manufacturing concern in a well-designed line of triplex pumps (operated by electricity or other source of power), with a view of manufacturing same. Address Box 242, AMER. MACH.

Wanted—Standard or special machinery to manufacture, by a concern having surplus facilities for light, medium and heavy work; new modern shops and equipment for the economical production of high-grade machinery; equipment ranges from automatic screw machines to 10-foot planers and 20-ton cranes. Box 286, AMERICAN MACHINIST.

For Sale.

Canada.—Double-blade hacksaw; cuts in half time; Canadian patent for sale; particulars. F. B. Wright, 177 Broadway, New York.

For Sale—Wilkinson planer, 30x12x8 in., chuck, countershaft, bench, A1 condition, $90; Olds 1 H.-P. engine, horizontal, stationary, new, $125. Box 54, St. Johnsbury, Vt.

For Sale—1 Farrell Foundry hydraulic pump and press; 800 tons; cost $1,950; will sell very reasonable; perfect condition. H. M. Crowell Mfg. Co., 6th ave. and 13th st., Newark, N. J.

Wants.

Situation and Help Advertisements only inserted under this head. Rate 25 cents a line for each insertion. About six words make a line. No advertisements under two lines accepted, and no advertisements abbreviated. The cash and copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded. Applicants may specify names to which their replies are not to be forwarded; but replies will not be returned. If not forwarded they will be destroyed without notice. Original letters of recommendation or other papers of value should not be enclosed to unknown correspondents. Only bona-fide situation want or help want advertisements inserted under this heading. Agency advertisements must be placed under Miscellaneous Wants.

Situations Wanted.

Classification indicates present address of advertiser, nothing else.

CANADA.

Superintendent or general foreman; American; age 38; specialty light manufacturing, interchangeable work; good executive; well up on factory system, costs, etc.; United States or Canada; best of references. Box 274, AMERICAN MACHINIST.

CONNECTICUT.

Mechanical draftsman and machinist; up to date in designing jigs and fixtures; thoroughly practical for manufacturing automobiles; now in charge of same. Box 275, A. M.

Foreman; a thorough mechanic; 20 years' experience in machine shop practise, general jobbing, special machinery and tools; had charge 7½ years; age 42; temperate; reliable references. Box 283, AMER. MACHINIST.

ILLINOIS.

Mechanical draftsman, technical graduate, 3 years' experience with engineering department of manufacturing concern, at present employed, desires change in same line. Box 277, AMERICAN MACHINIST.

MASSACHUSETTS.

Mechanical draftsman wishes to change. Address Box 298, AMERICAN MACHINIST.

Mechanical engineer with shop and technical training wants a position with reliable firm; can furnish references. Box 299, A. M.

MICHIGAN.

Position of responsibility by technical graduate; competent; reliable; experienced designer; automatic machines, machine tools, fixtures; inventive and organizing ability; able to handle men. Box 278, AM. MACH.

NEW JERSEY.

General draftsman and mechanical engineer wants position. Box 208, AM. MACH.

Mechanical draftsman; age 26; American; graduate I. C. S. course electrical engineering; 10½ years' shop and office experience; location immaterial. Box 284, AM. MACH.

NEW YORK.

Experienced draftsman, graduated, wants position; electrical line preferred. Box 296, AMERICAN MACHINIST.

Mechanical engineer, junior member A. S. M. E., would like to take Eastern agency for reputable concern. Box 280, AMER. MACH.

Foundry superintendent is open to correspondence; engine and machinery; good references. Address Box 261, AMER. MACHINIST.

Foreman, expert tool and die maker, exceptional ability handling men and systematizing work, at liberty September 1. Box 248, AMERICAN MACHINIST.

Mechanic, wide experience, technical education, speaks four languages, wishes position; salesman or demonstrator. Box 254, AMERICAN MACHINIST.

Young man, 6 years' experience, shop and drafting room, wants position with concern manufacturing engines and boilers; references exchanged. Box 273, AMER. MACH.

Graduate mechanical engineer, age 26, desires making change; present salary twelve hundred; give details of nature of work and salary offered. Address Box 295, AM. MACH.

Position as superintendent or general foreman, by a thoroughly up-to-date mechanic, 37, with 20 years' experience on machine tools, interchangeable machinery and automobile manufacture. Box 220, AM. M.

Young man (21) desires position with consulting engineer; have experience at mechanical drawing and 4 years at machinist trade; willing to start at small salary. Cooper Union Student, care AMERICAN MACHINIST.

Situation wanted by mechanical engineer; well educated; 3 years' drawing office, 7 years' practical shop training with first-class concern; specialty, naval and marine work; young, vigorous and progressive. Box 297, AMERICAN MACHINIST.

Designer and draftsman, technical graduate, 16 years' shop and office experience on marine, stationary steam and gas engines, tools and jigs, 5 years as chief engineer, is open to responsible position. Address Box 292, AMERICAN MACHINIST.

Mechanical engineer will be open for engagement in September as superintendent or master mechanic; technical education and large experience in the manufacture of small interchangeable machinery, sheet metal goods, etc. Address Box 244, AMER. MACHINIST.

PENNSYLVANIA.

Mechanical draftsman wishes position as assistant draftsman or tracer. Box 271, A. M.

A designing draftsman with technical education, tool-room experience and several years with leading concerns at designing special machinery, tools and fixtures for manufacturing purposes; have handled some difficult problems satisfactorily and will soon be ready for another. Address Box 279, AMER. MACH.

WEST OF MISSISSIPPI.

Tool and die room foreman (27); typewriters, machine tools, electrical machinery, bicycles, subpress dies, etc.; good education; A1 references. Box 272. AMER. MACHINIST.

WISCONSIN.

Mechanical engineer and draftsman, experienced in shop and office, college graduate, desires position; best references. Box 281, AMERICAN MACHINIST.

Help Wanted.

Classification indicates present address of advertiser, nothing else.

CANADA.

Wanted—Several first-class draftsmen, used to light interchangeable work; state experience and wages wanted. Box 288, AM. M.

Wanted—First-class engineer and draftsman; technical graduate preferred; one with experience in water-wheel, pulp and sawmill work; state age and experience. Box 205, AMERICAN MACHINIST.

ENGLAND.

Brass and copper tube and wire, rolled metals, etc.; sub-manager wanted in English, large, old-established works; must be thoroughly and practically experienced, active and up-to-date; state age, experience and terms. Address "Tubes," Smith & Son, Union street, Birmingham, England.

ILLINOIS.

Wanted—In Chicago, first-class toolmakers for sub-press dies and general tools. Address Box 237, AMERICAN MACHINIST.

Wanted—Capable electrical machinery salesman; technical graduate preferred; state age, experience, references and salary expected. Box 294, AMERICAN MACHINIST.

Wanted—Electrical engineer as shop superintendent at factory located in Middle West, manufacturing full line of electrical machinery; state age, experience, references and salary expected. Box 293, AMER. MACHINIST.

MICHIGAN.

Wanted—A recent graduate as assistant in a technical school mechanical engineering laboratory and drawing room. Box 153, A. M.

NEW JERSEY.

Foreman to take charge of department of works employing 100 men; executive ability and capacity to push work most essential; give age, experience and salary expected. Box 269, AMERICAN MACHINIST.

NEW YORK.

Operators.—Two young men to set up and operate fine automatic wire-working machines; must be skillful, competent and steady; permanent positions to right men. Address Box 285, AMERICAN MACHINIST.

A general manager or superintendent wanted for a well-established, good-going manufacturing company; investment $5,000 required in first mortgage bonds; salary $3,000 to just the right man. Box 291, A. M.

Wanted—For general superintendent of a large modern shop manufacturing high-grade machinery, a young man of sterling character and executive ability who is familiar with modern shop methods and the management of men; only those of experience and proven ability will be considered; whosoever can furnish sufficient evidence of ability and worth to receive favorable consideration, will be expected to invest from $5,000 to $10,000, to the end that he will have the same interest in the general success as all other heads of departments. Box 287, AMER. MACHINIST.

OHIO.

Wanted—A mechanical and electrical engineer for a manufacturing plant. Address The Wehrle Co., Newark, O.

Wanted—First-class machinist who has executive ability; able to take charge of 12 to 15 men in medium and light class of work; a good position to the right man. Address, with reference, Box 249, AMER. MACHINIST.

PENNSYLVANIA.

Wanted—A first-class draftsman. Address Box 217, AMERICAN MACHINIST.

Wanted—Assistant superintendent on light iron specialties; must have had experience in manufacture of sheet steel furniture or similar goods; give references and state salary expected. Address Box 289. AMER. MACH.

Wanted—First-class toolmakers and machinists; we have a model shop, new tools, no labor troubles, plenty of work, and are situated in a small town where living is cheap and where all advantages can be secured. Address The Greer-Clarkson Co., Manheim, Pa.

Wanted—Salesman of experience to travel in Eastern and Middle States, representing a manufacturer making a general line of tools and drop forgings, chiefly for railroad consumption; state age, experience and salary expected. Box 276. AMERICAN MACHINIST.

Wanted—An experienced and successful salesman, familiar with high-grade steam engines, to travel from the home office, also to assist branch sales offices in special cases; the management of sales department awaits the right man who can demonstrate his fitness; only those who can handle large as well as small deals, who can show a successful record and who are now similarly employed, will receive consideration. Box 270, AM. M.

The Monotype Company maintains a school to train young men to meet the constantly increasing demand for operators of its type casting and composing machine. These operators have done so well that it receives more applications for places than can be filled. In making selections these equalifications carry most weight: common sense, type foundry experience, printing office experience, automatic machinery experience. Full particulars will be furnished to inquirers who furnish the same information about themselves. The Lanston Monotype Machine Co., 1231 Callowhill st., Philadelphia, Pa.

WEST VIRGINIA.

Wanted—Good vise and lathe hands; good wages; steady employment; no strike; good chance for promotion. Answer Agnew Electric Co., Charleston, W. Va.

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